

Figure 1

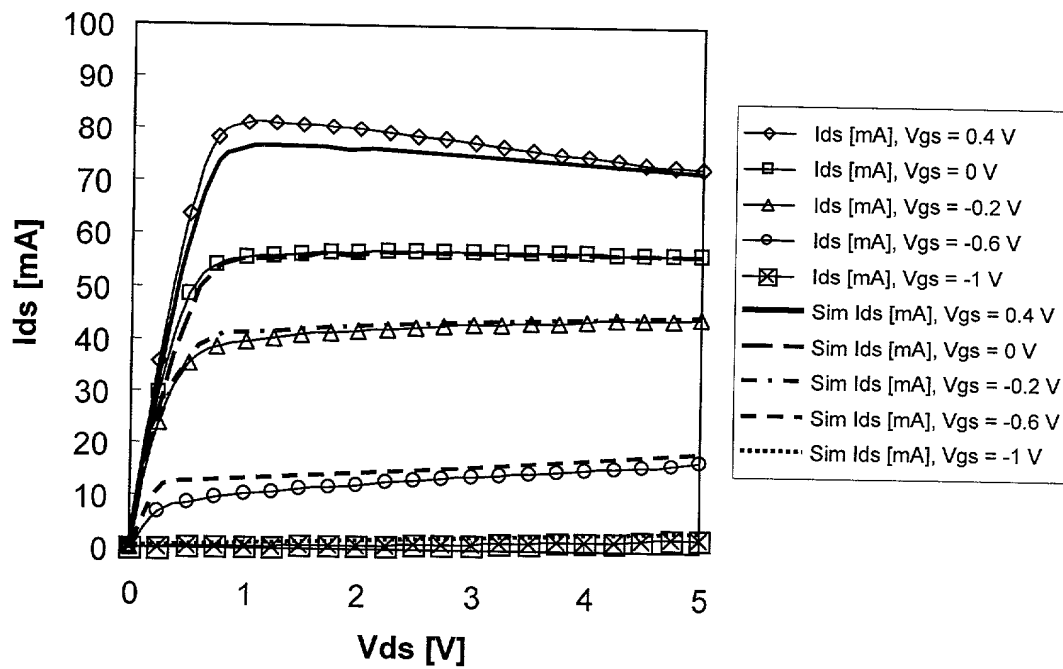


Figure 2

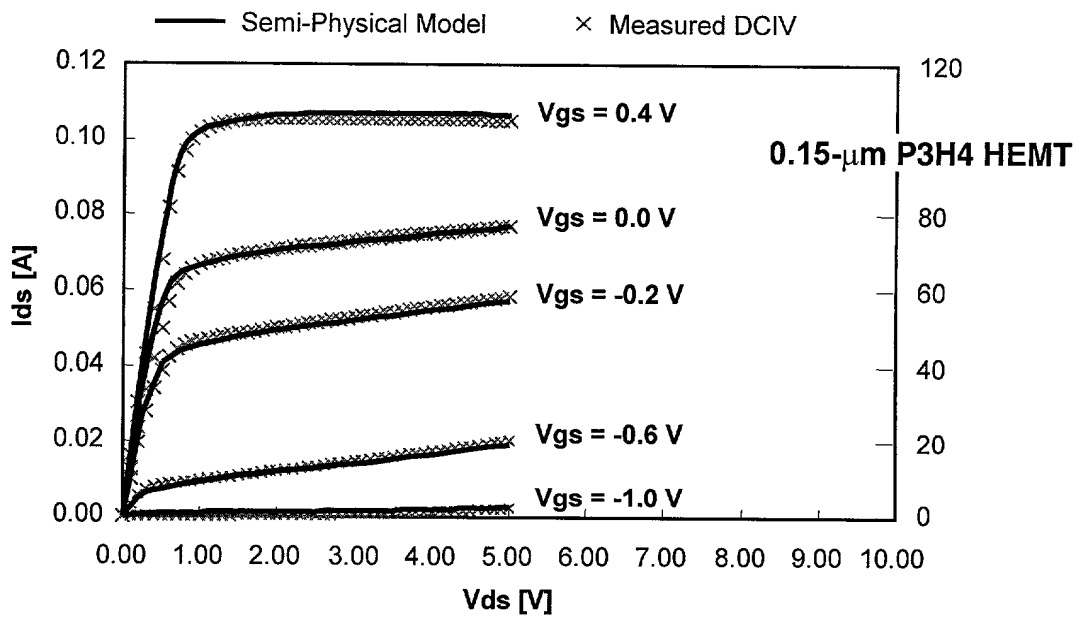


Figure 3

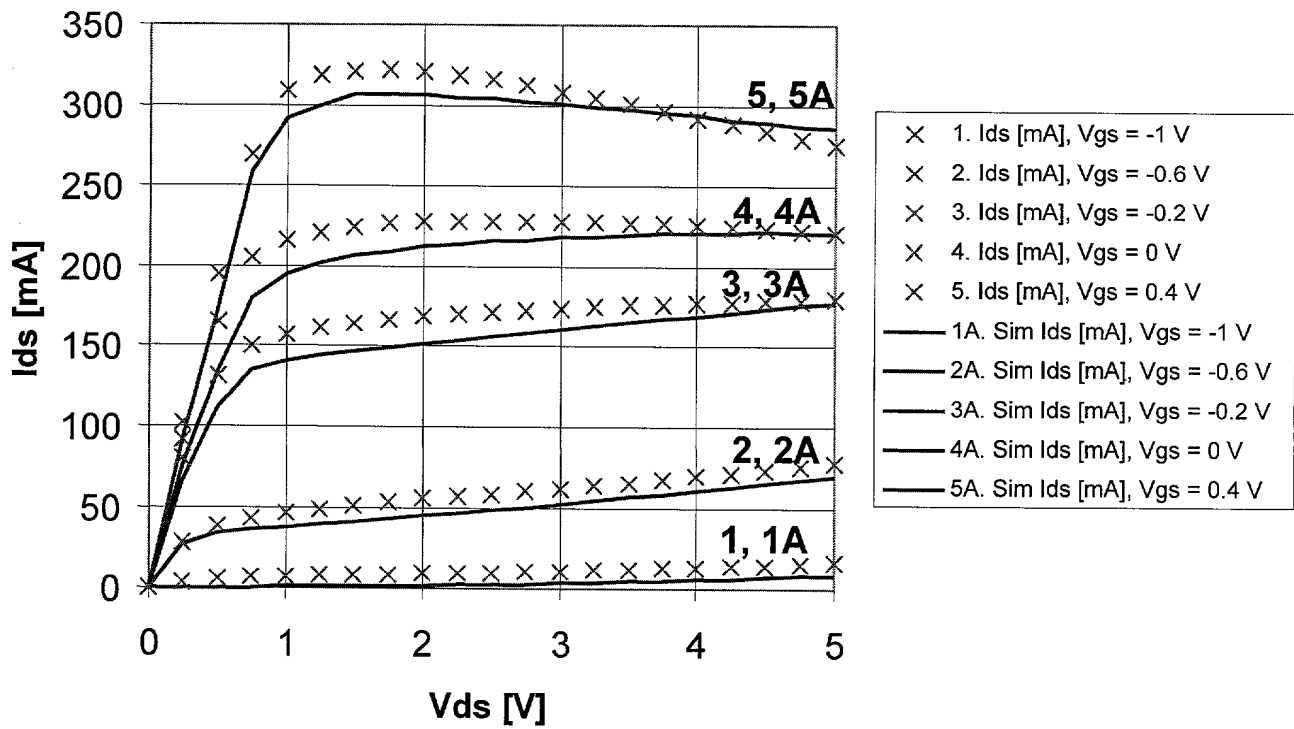


Figure 4

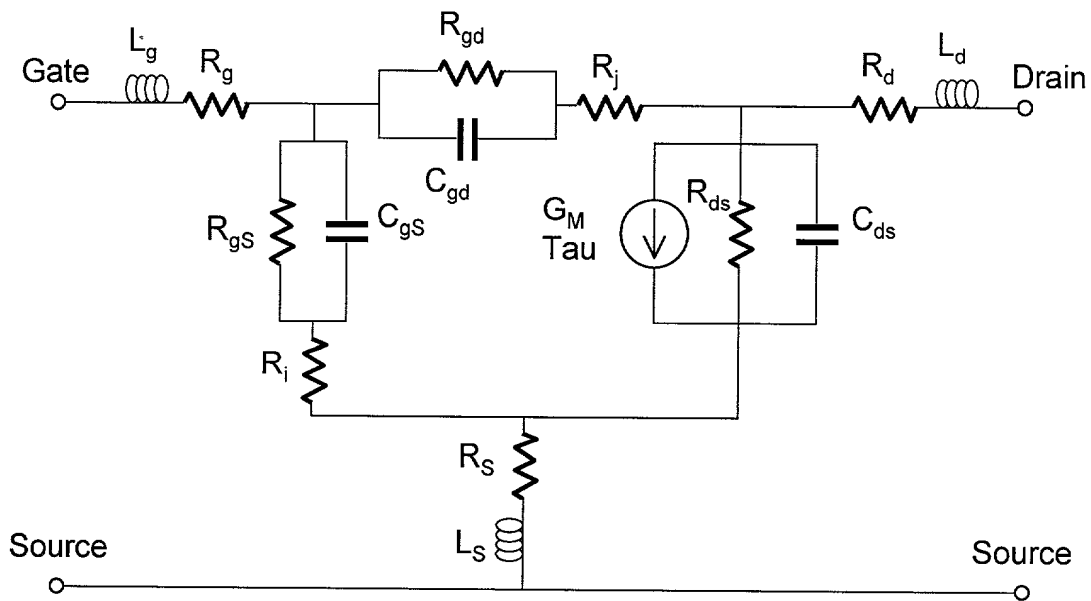


Figure 5

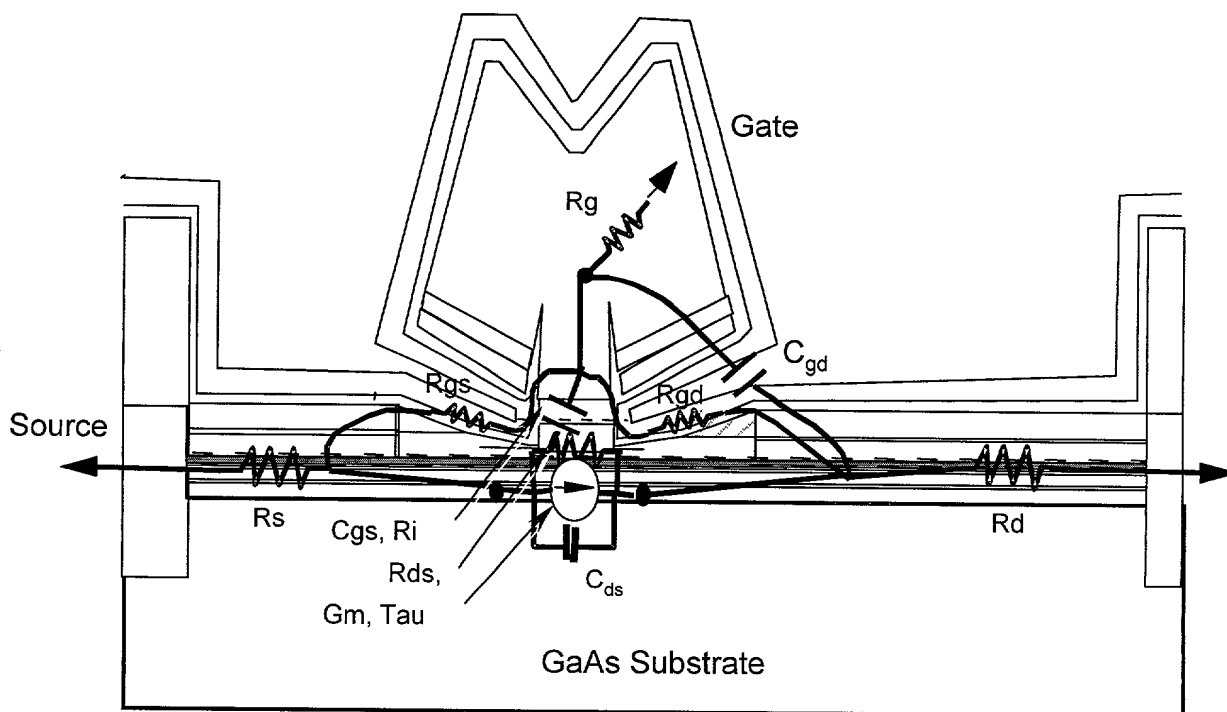


Figure 6

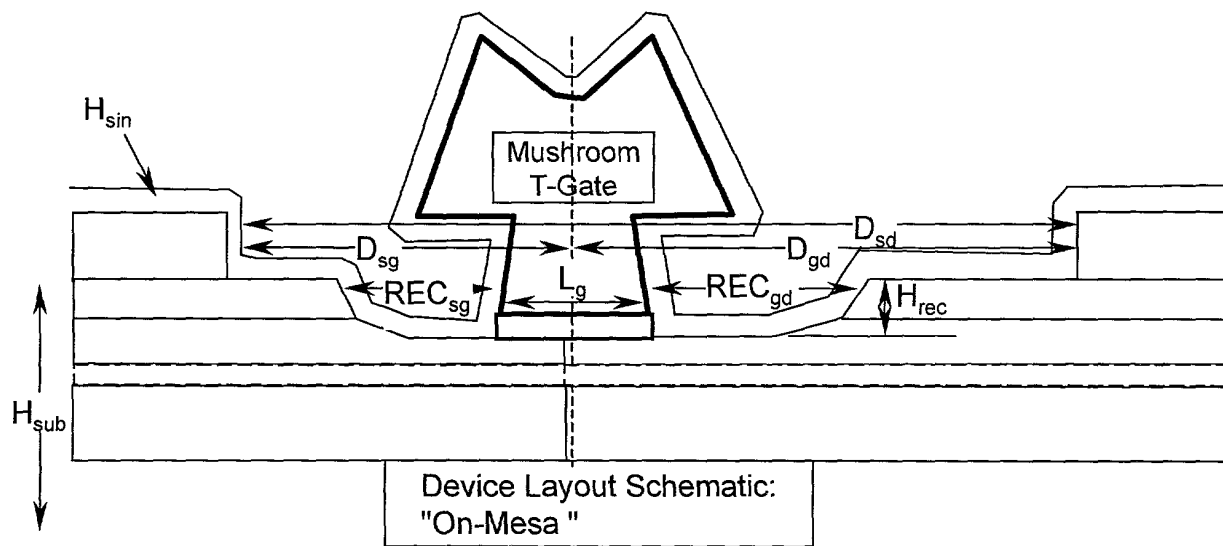


Figure 7

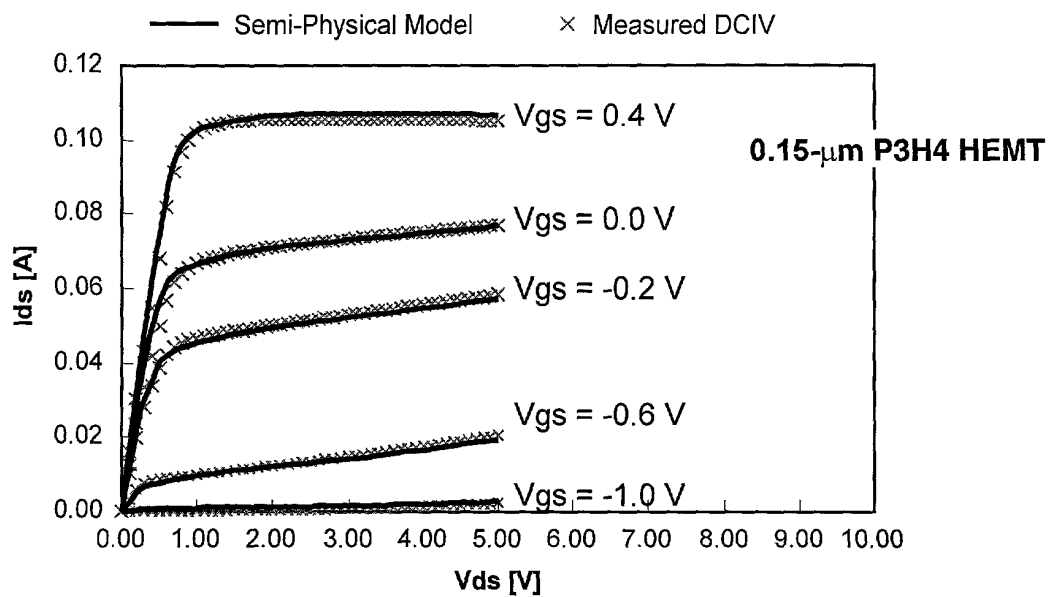


Figure 8

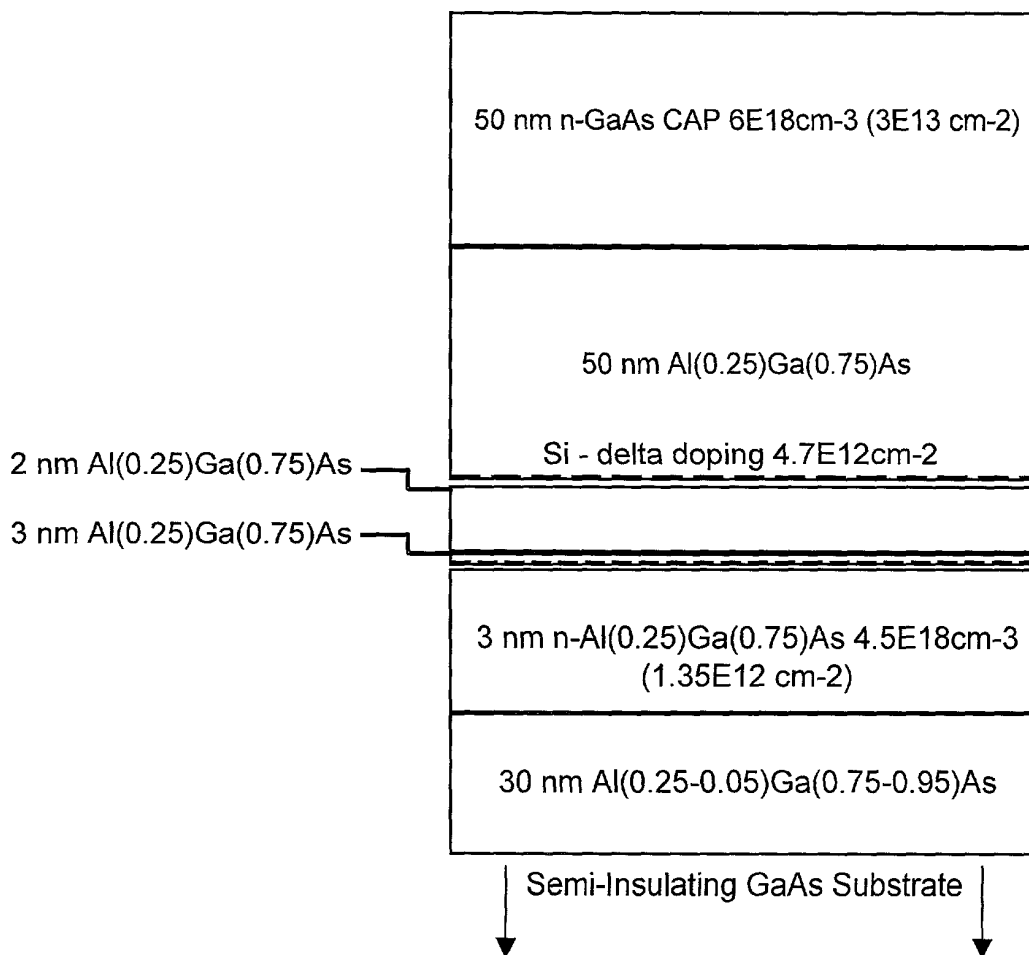


Figure 9

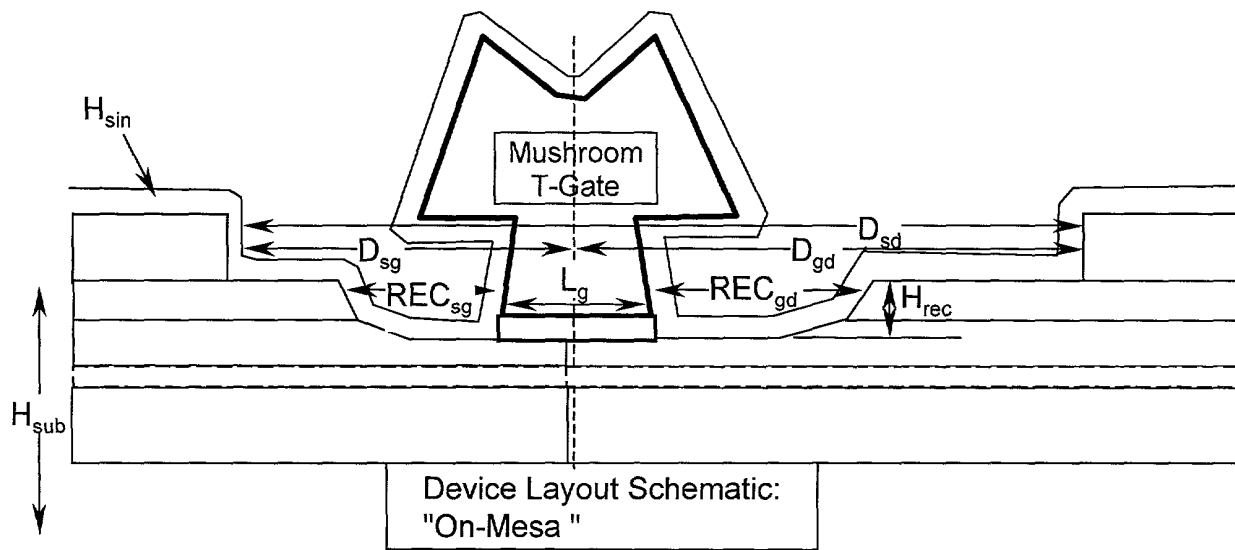


Figure 10

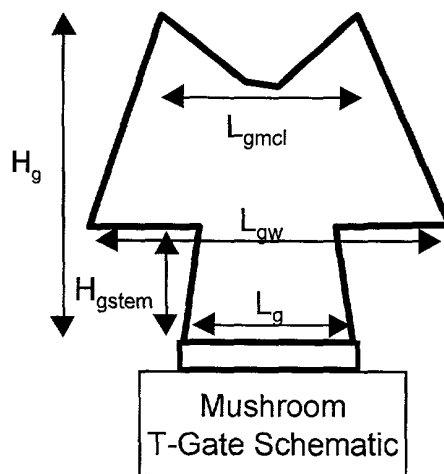


Figure 11

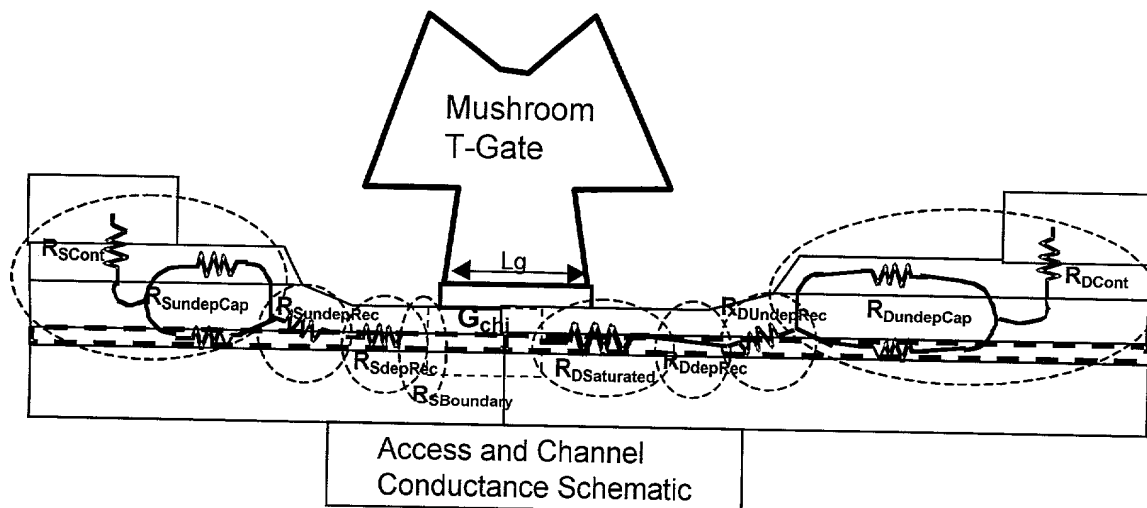
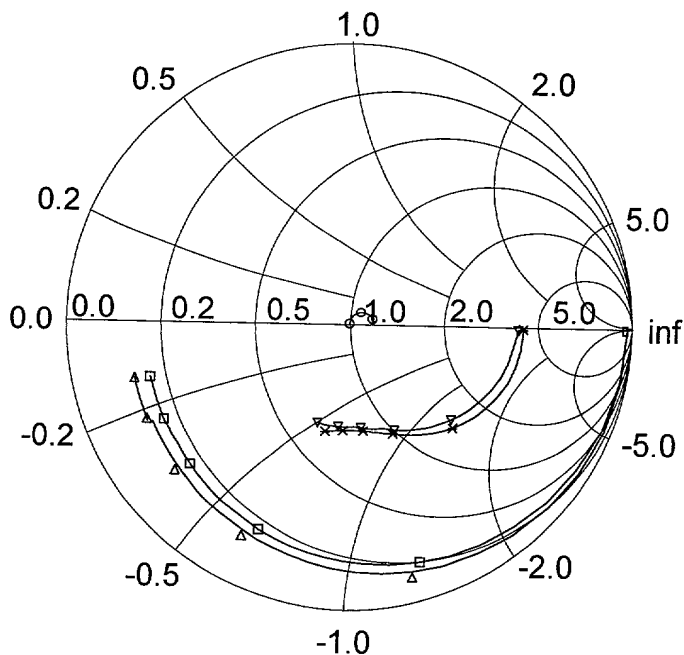
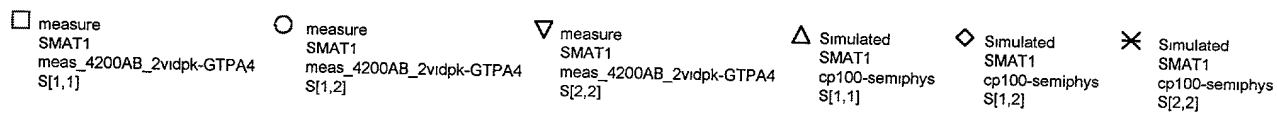


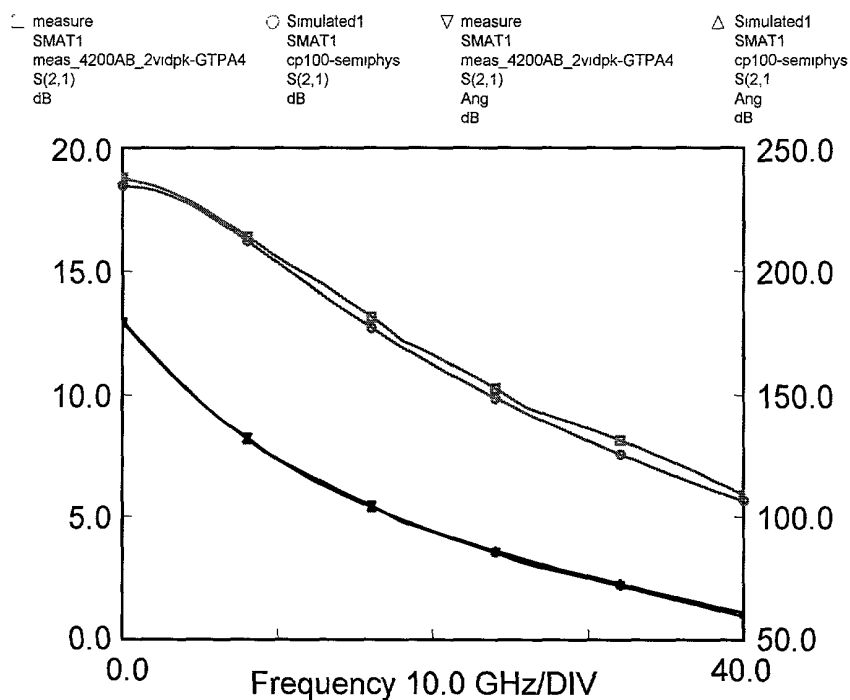
Figure 12



Frequency 0.05 to 40.05 GHz

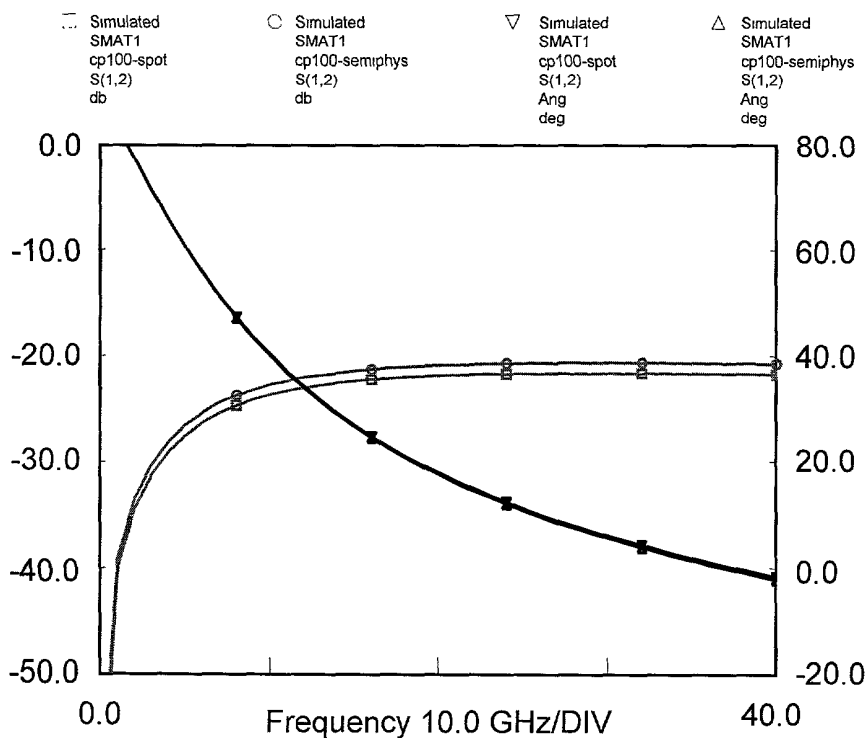
Measured vs Modeled S-parameters
Simulated Equivalent Circuit Element Values
via Semi-Physical HEMT Model

Figure 13



Measured vs Modeled S12
Simulated Equivalent Circuit Element Values via
Semi-Physical HEMT Model

Figure 14



Measured vs Modeled S12
Simulated Equivalent Circuit Element Values via
Semi-Physical HEMT Model

Figure 15

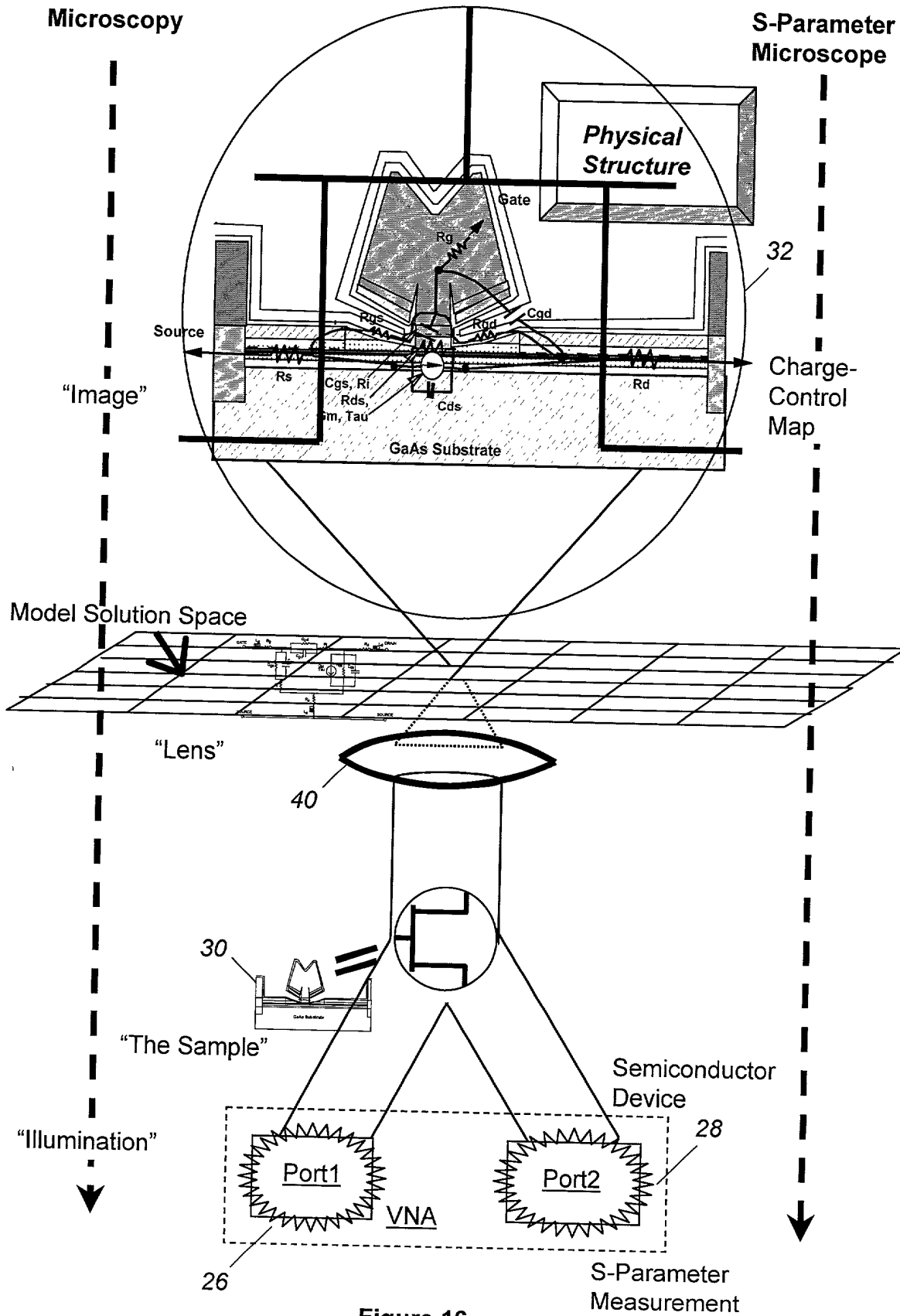


Figure 16

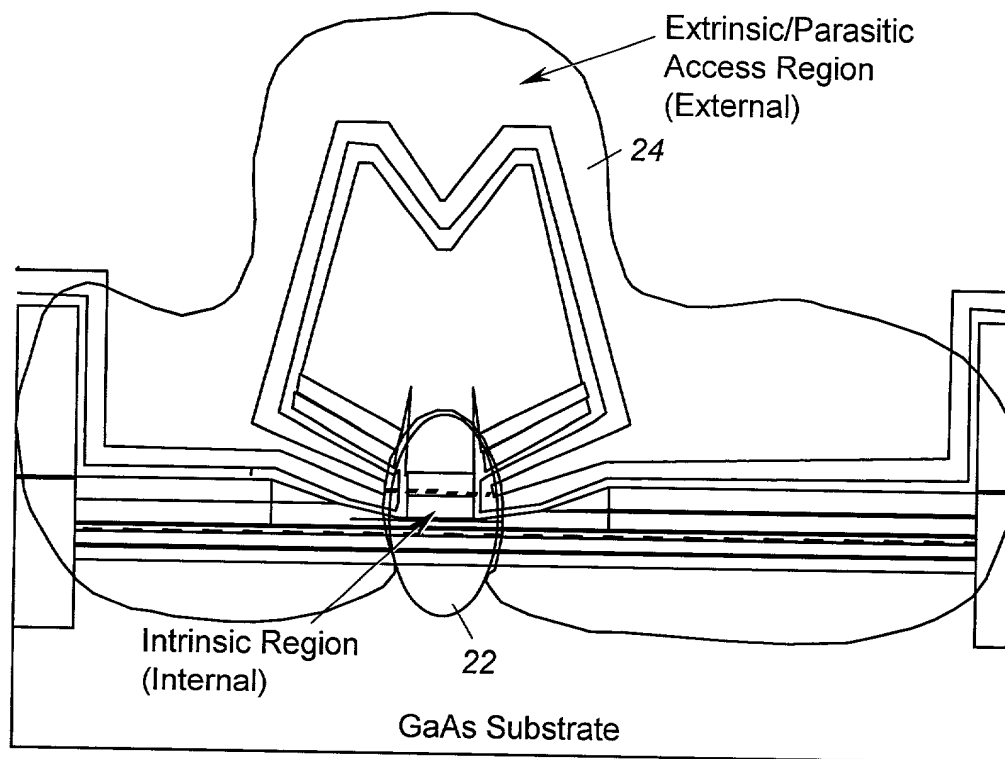


Figure 17

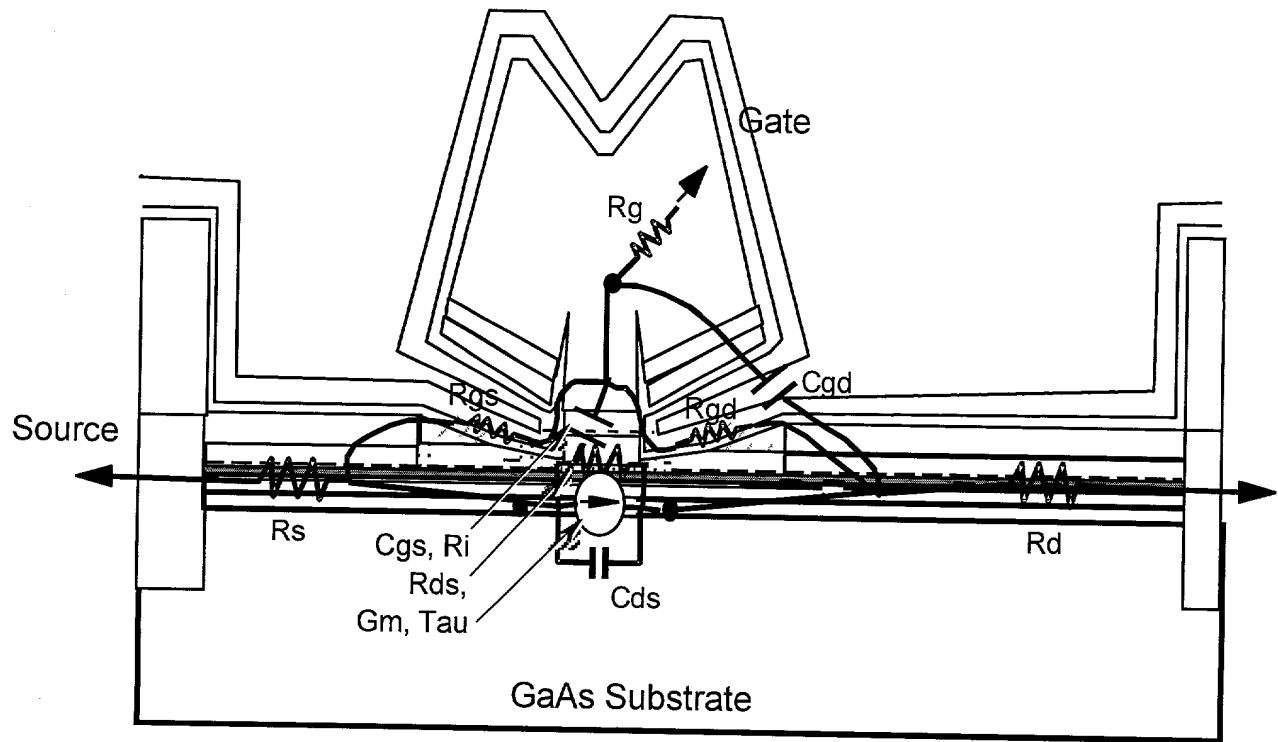


Figure 18

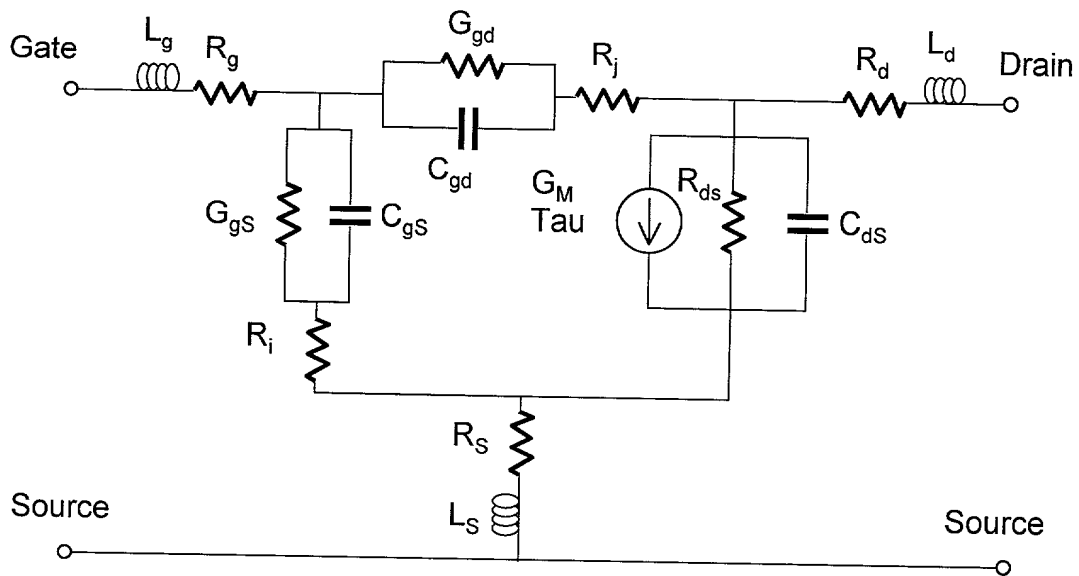


Figure 19

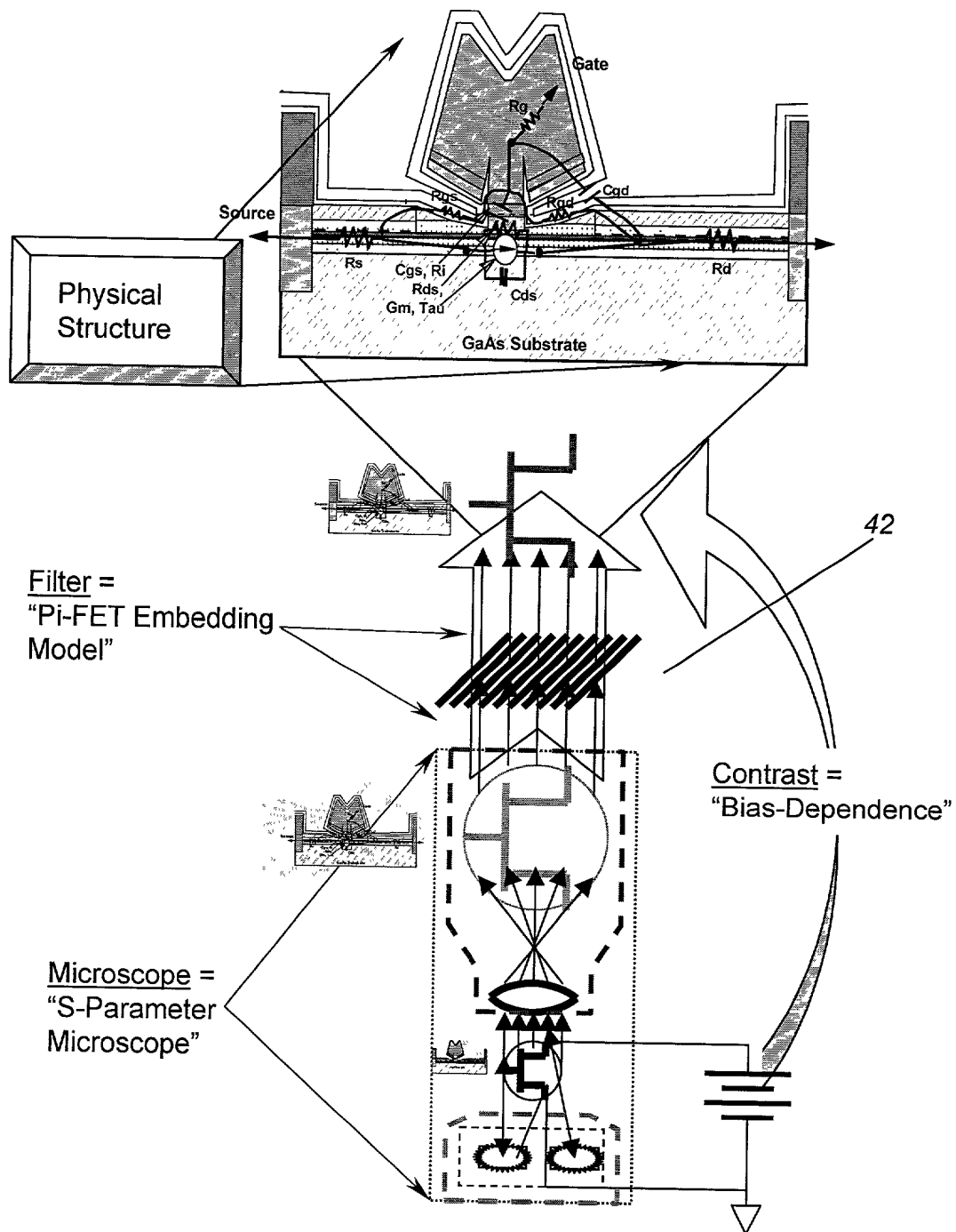


Figure 20

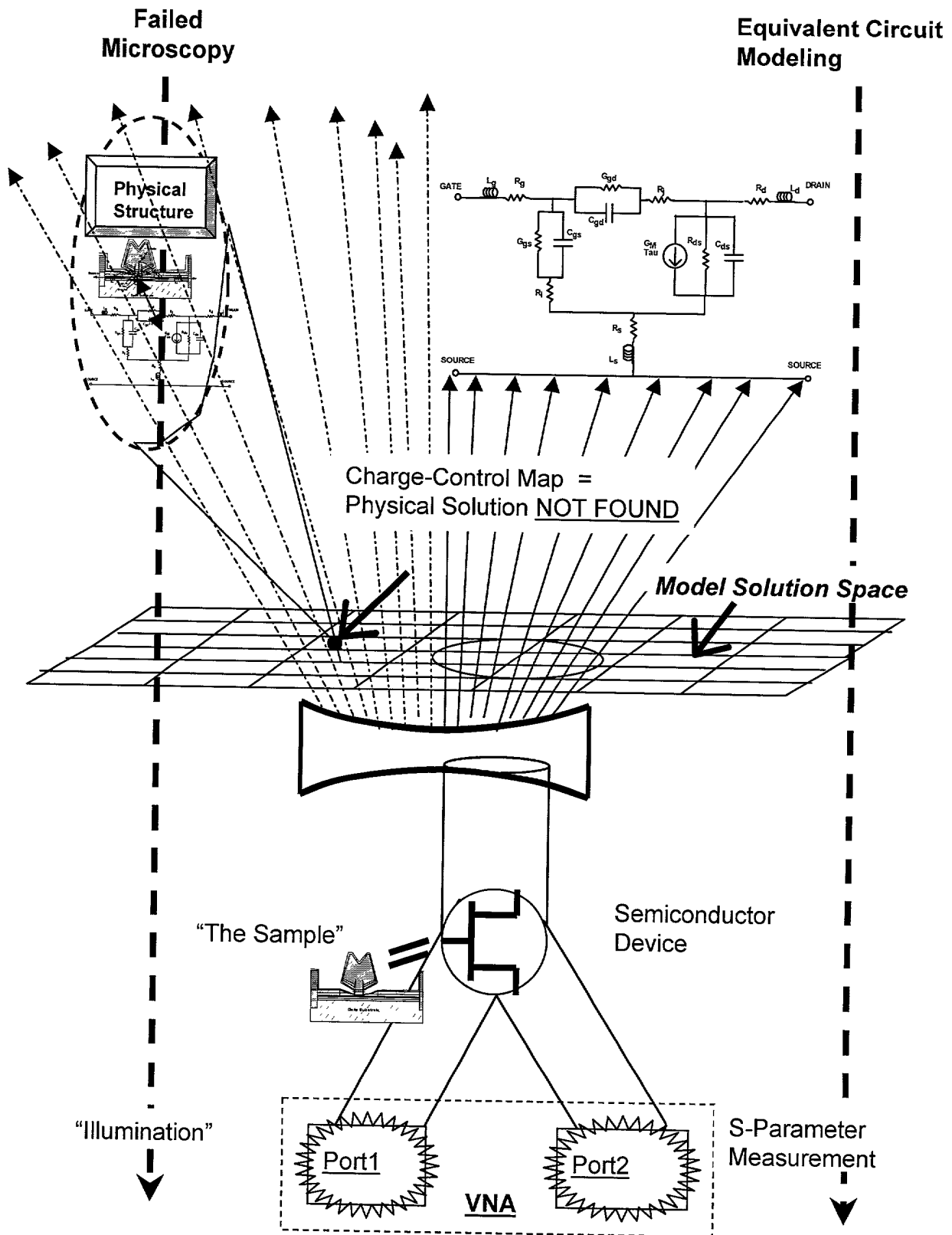


Figure 21

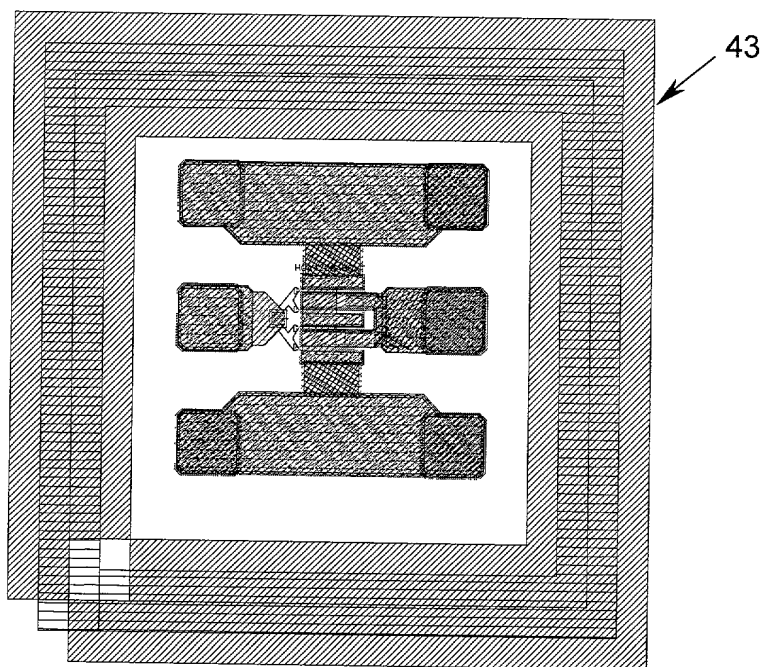


Figure 22

Ids vs Vds for the Measured HEMT Device

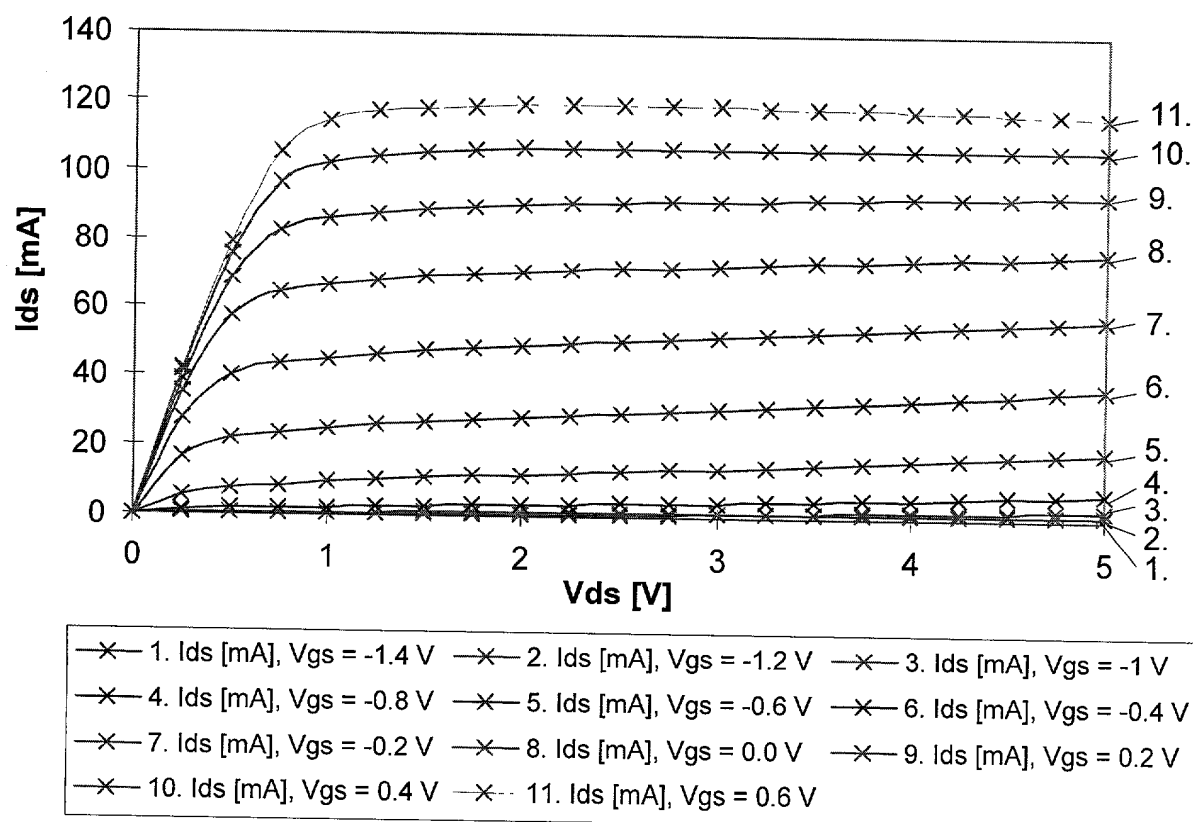
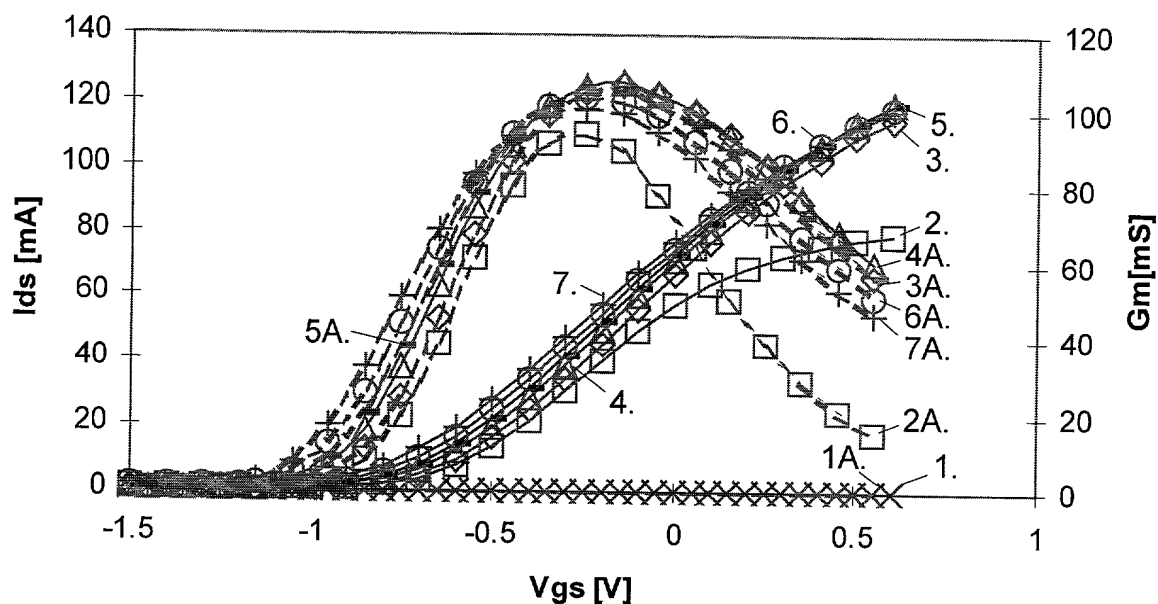


Figure 23

Ids and Gm vs Vgs for the Measured Device



—×— 1. Ids [mA], Vds = 0 V	—□— 2. Ids [mA], Vds = 0.5 V	—◇— 3. Ids [mA], Vds = 1 V
—△— 4. Ids [mA], Vds = 2 V	—■— 5. Ids [mA], Vds = 3 V	—○— 6. Ids [mA], Vds = 4 V
—+— 7. Ids [mA], Vds = 5 V	—×— 1A. Gm [mS], Vds = 0 V	—□— 2A. Gm [mS], Vds = 0.5 V
—◇— 3A. Gm [mS], Vds = 1 V	—△— 4A. Gm [mS], Vds = 2 V	—■— 5A. Gm [mS], Vds = 3 V
—○— 6A. Gm [mS], Vds = 4 V	—+— 7A. Gm [mS], Vds = 5 V	

Figure 24

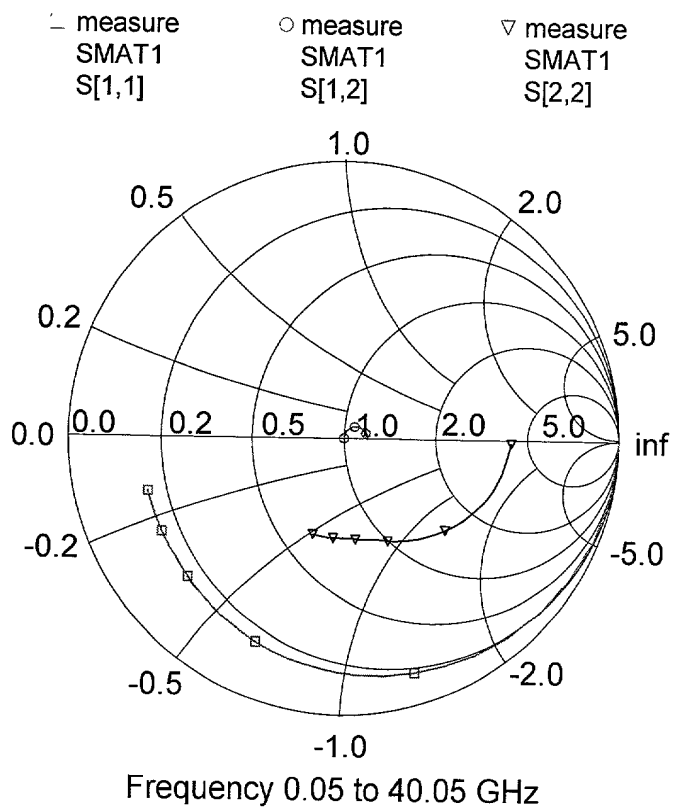


Figure 25

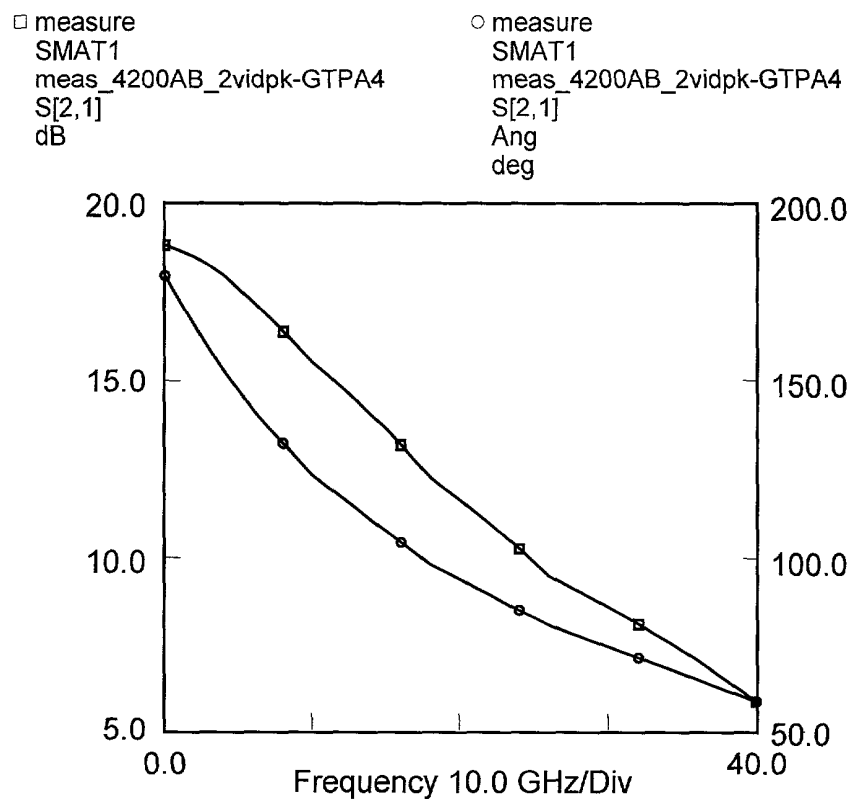


Figure 26

Intrinsic Device Source Resistance vs Gate Bias

0.15 μm P3H4 HEMT

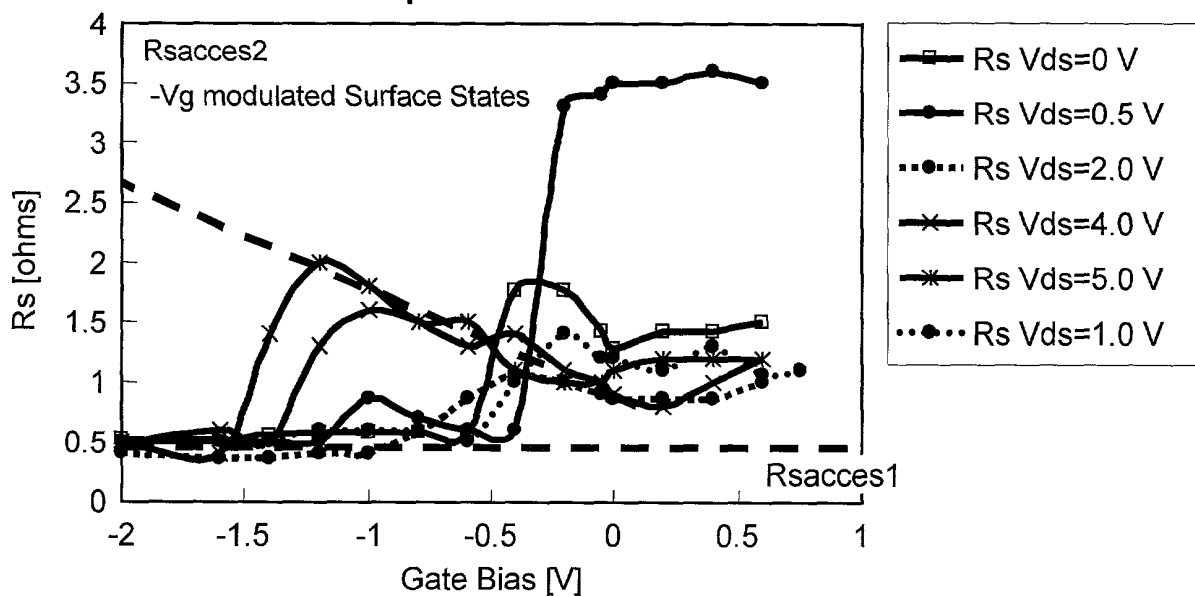


Figure 27

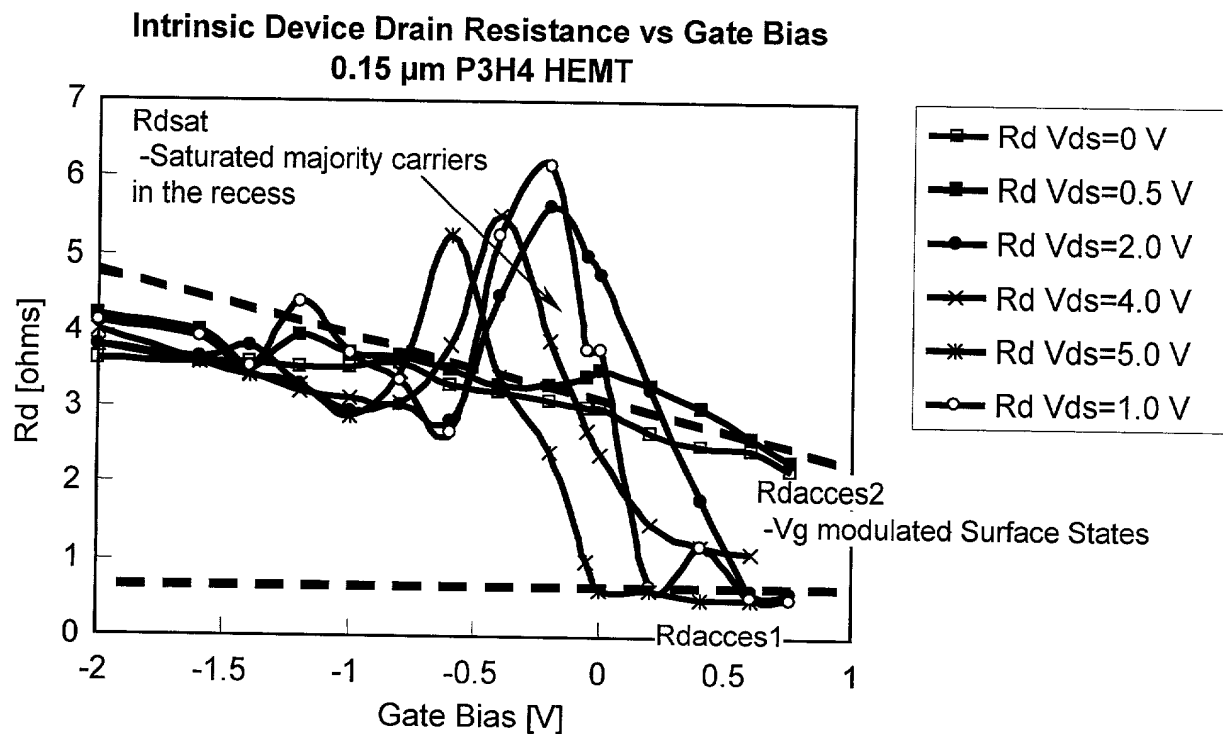


Figure 28

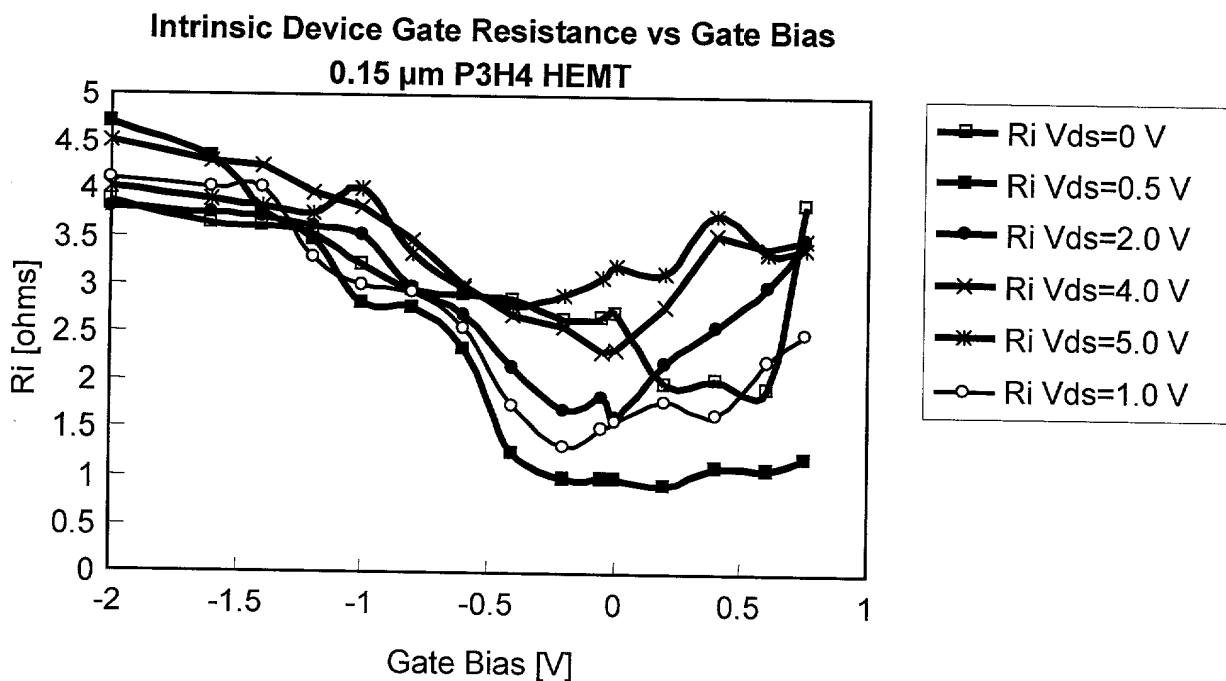


Figure 29

Prepared by: [illegible]

Intrinsic Device Line Capacitance vs Gate Bias 0.15 μ m P3H4 HEMT

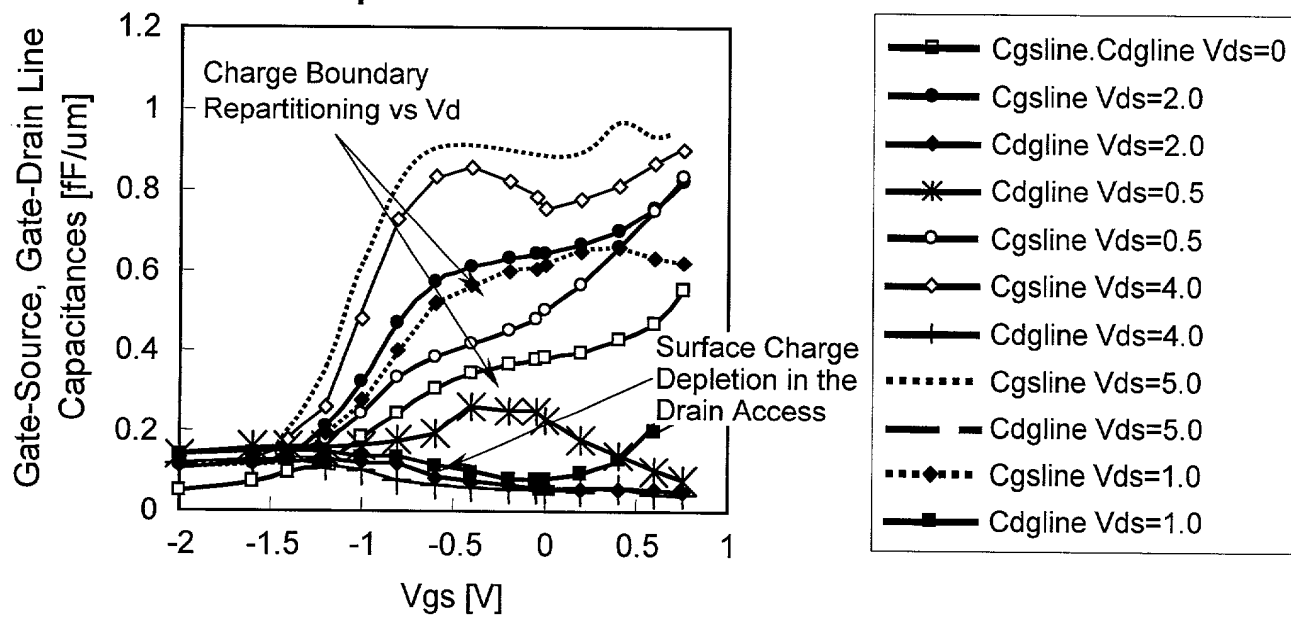


Figure 30

Figure 31

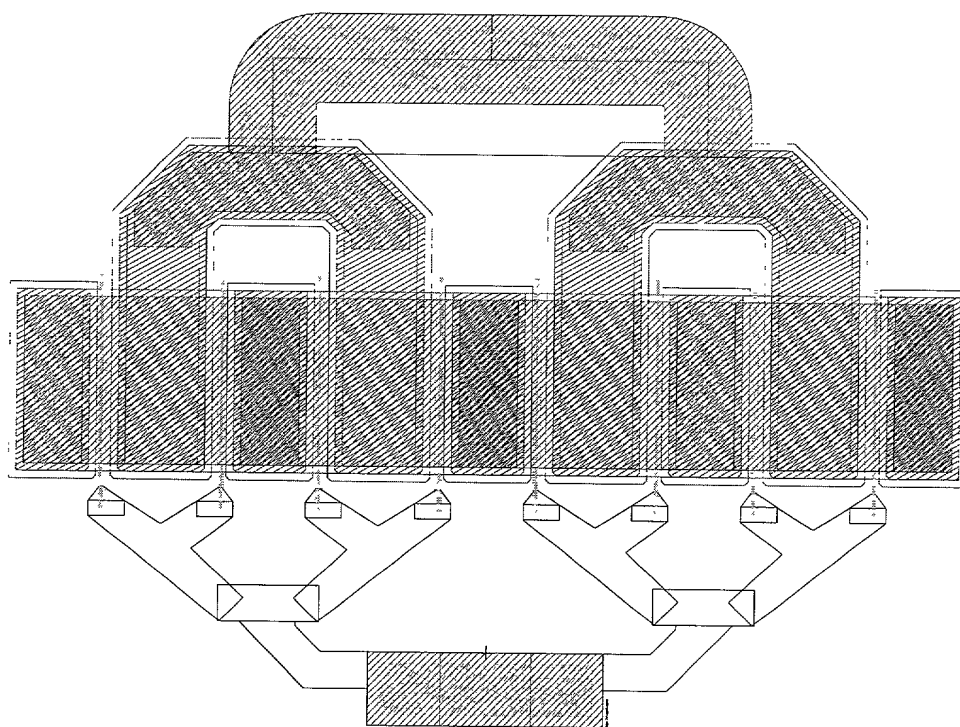


Figure 32

Model Construction

- 1) Off-Mesa, or Boundary Parasitic Model
- 2) Inter-electrode Parasitic Model
- 3) On-Mesa Parasitic Model
- 4) Intrinsic Model

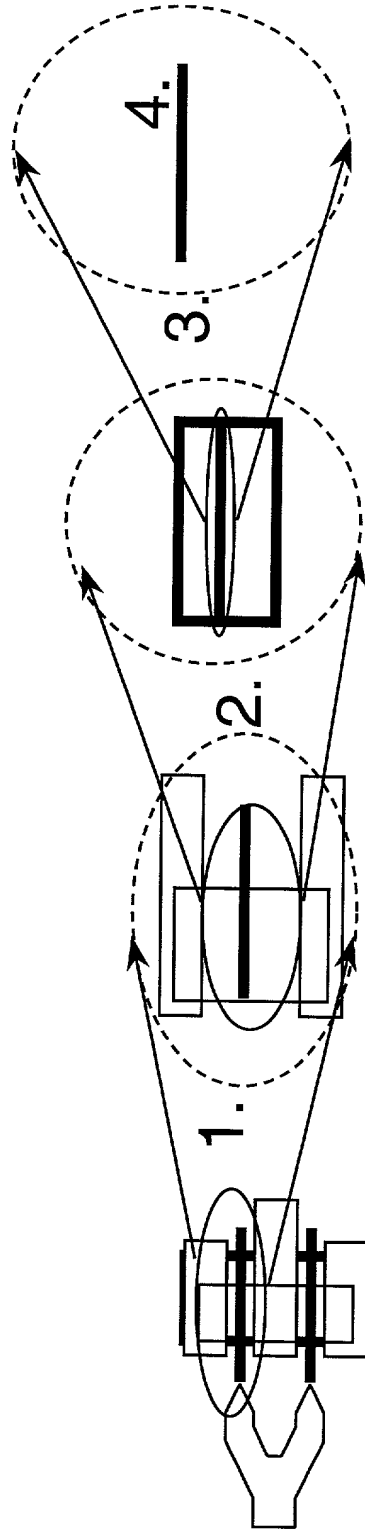


Figure 33

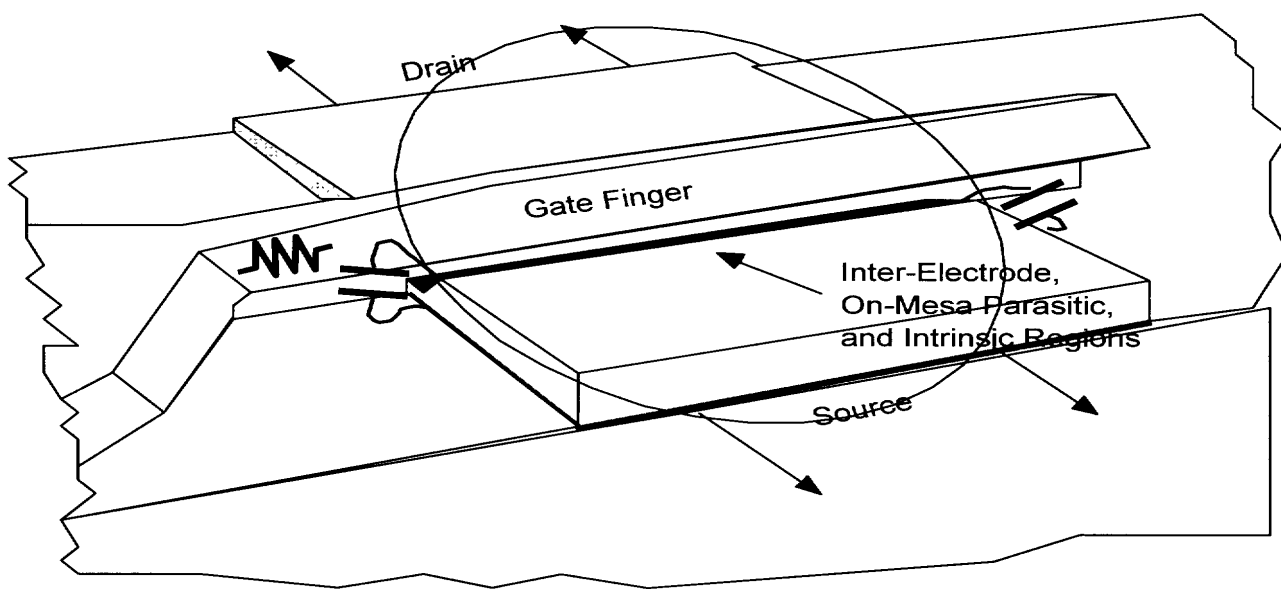


Figure 34

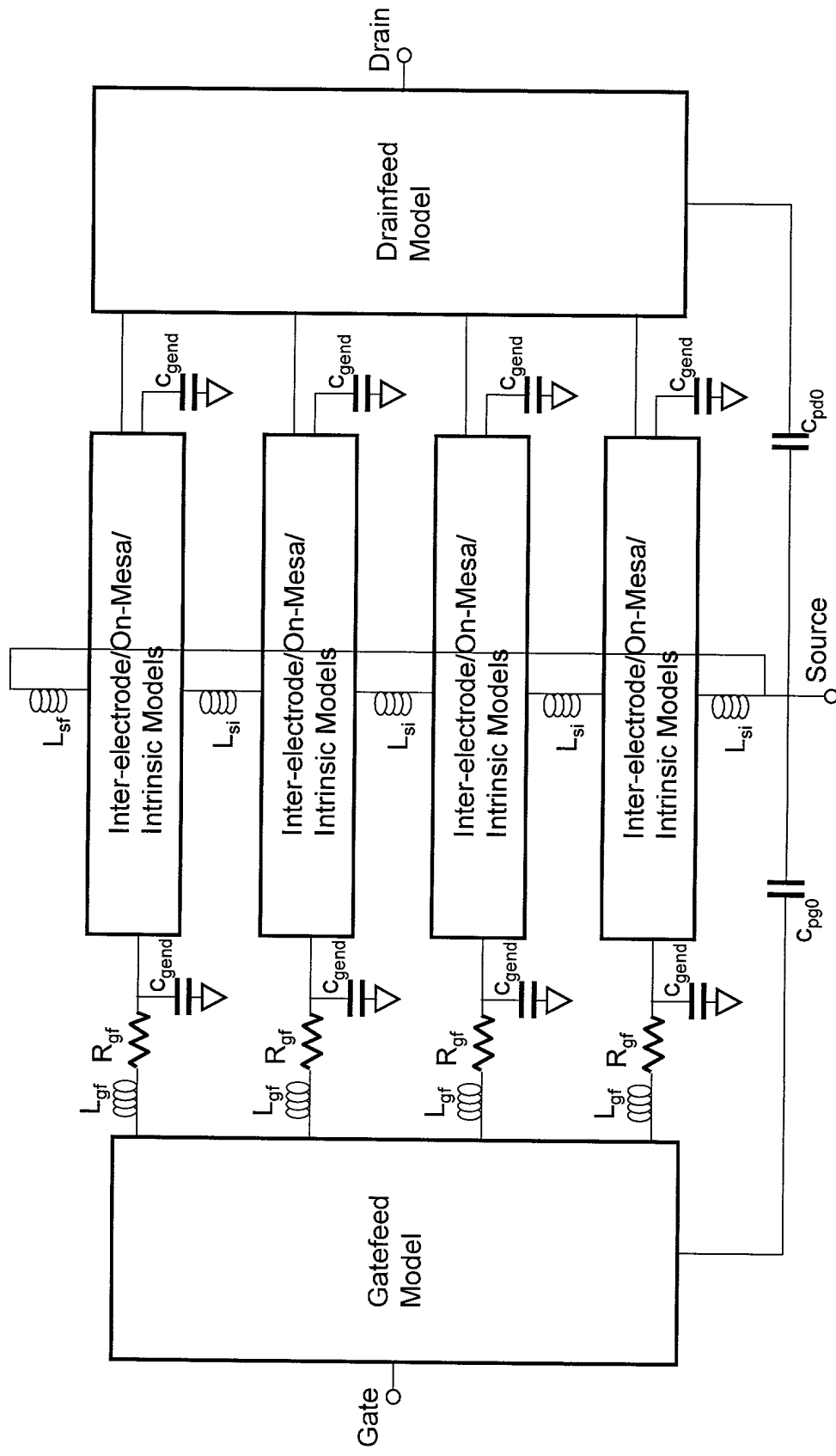


Figure 35

Table 1 Demographic characteristics of study population

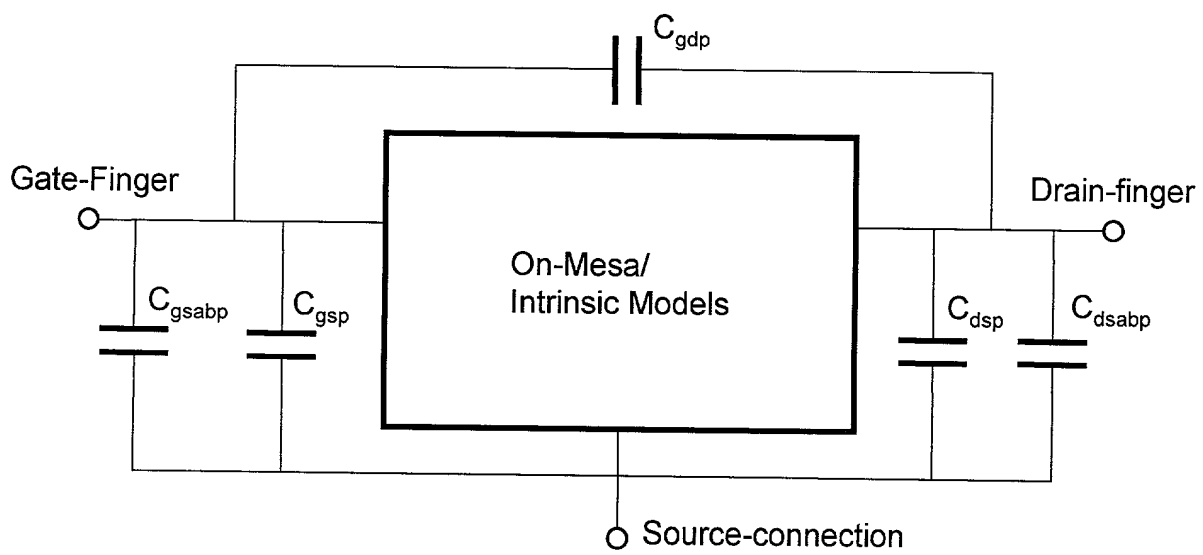


Figure 37

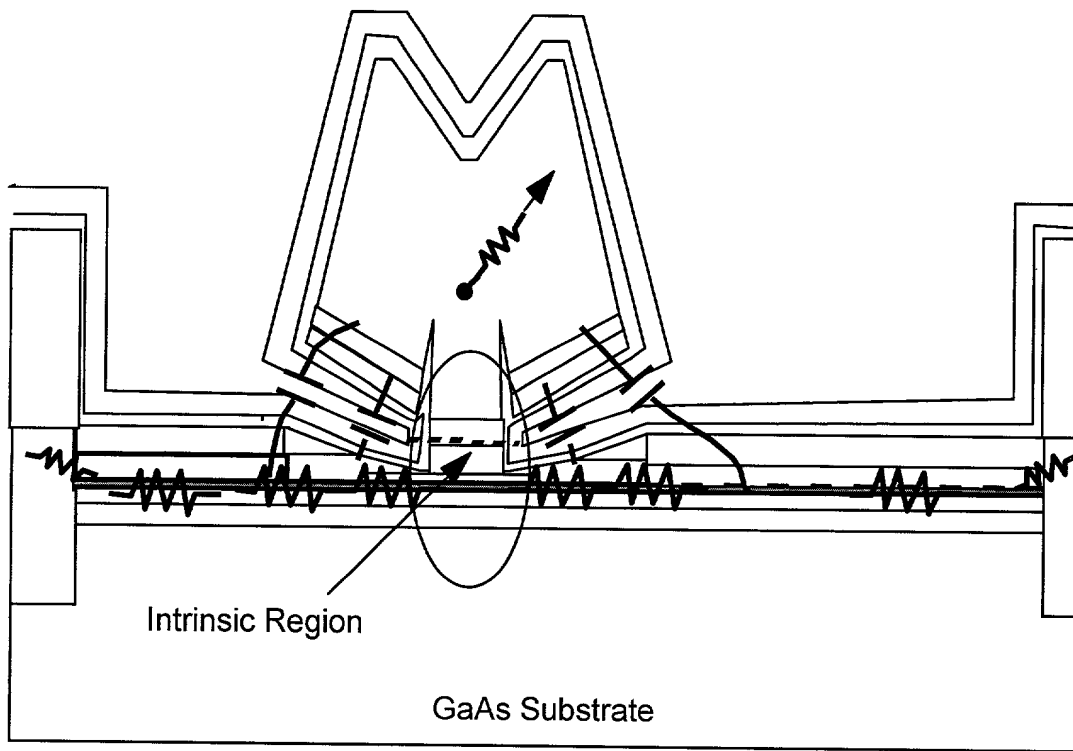


Figure 38

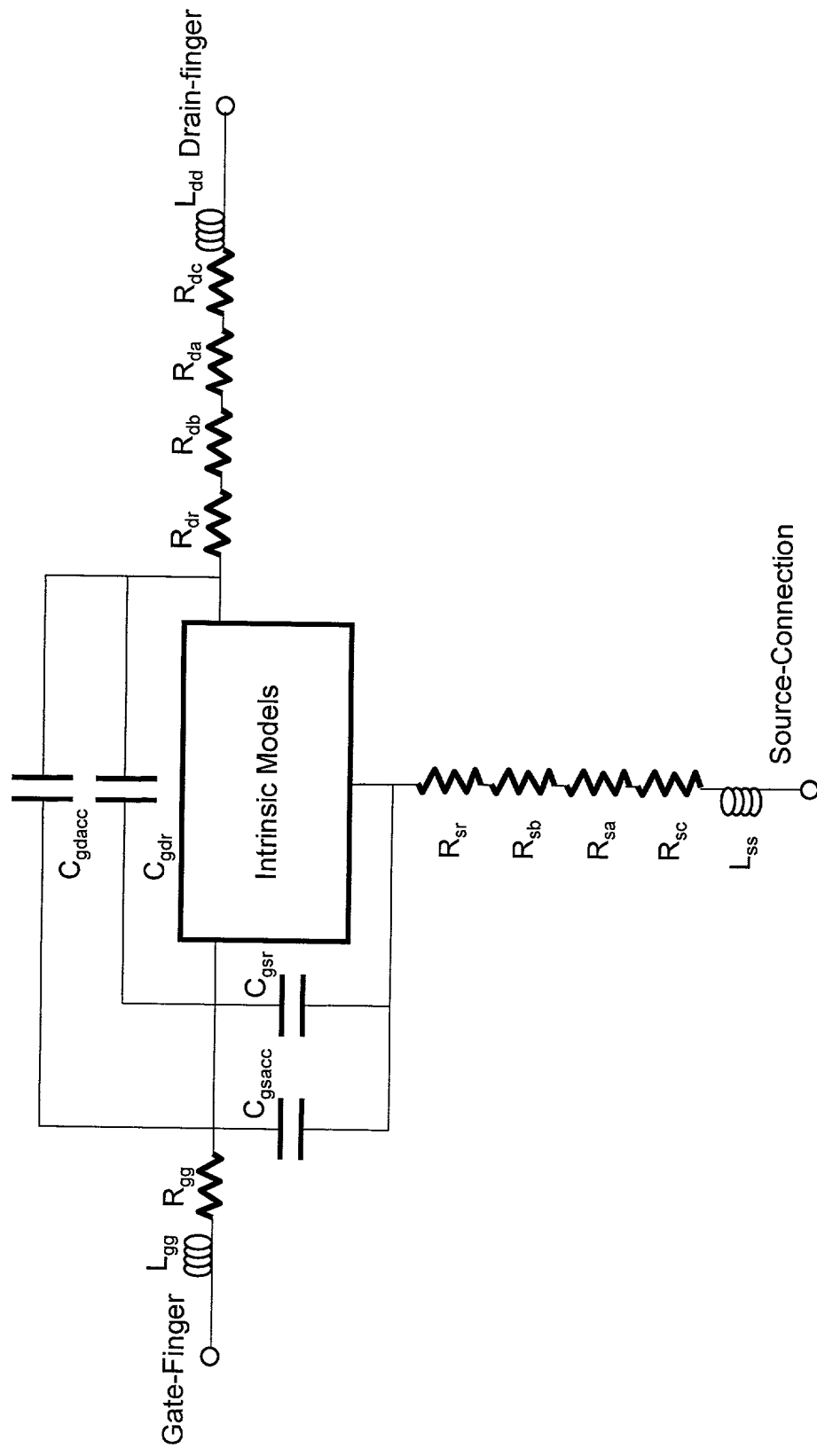


Figure 39

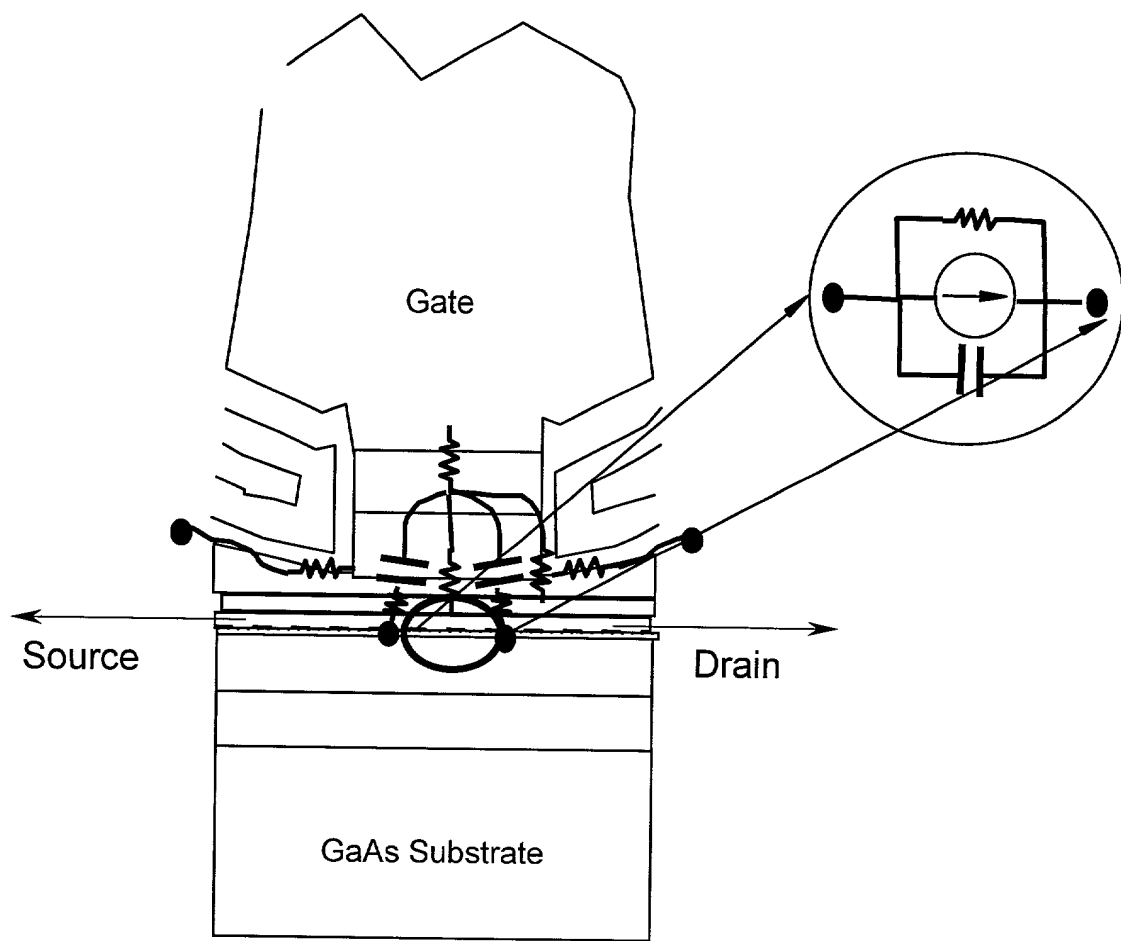


Figure 40

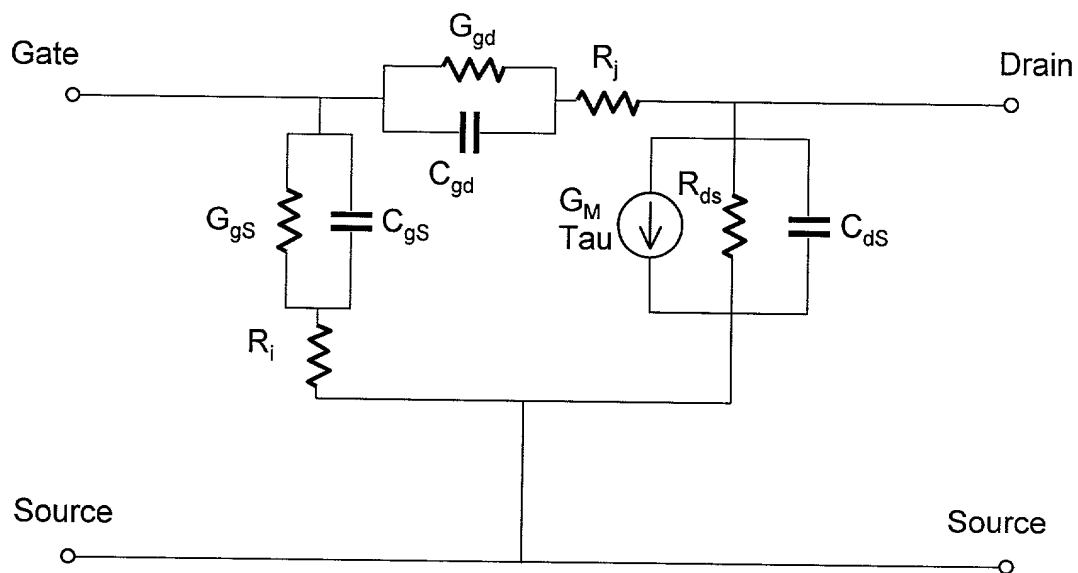


Figure 41

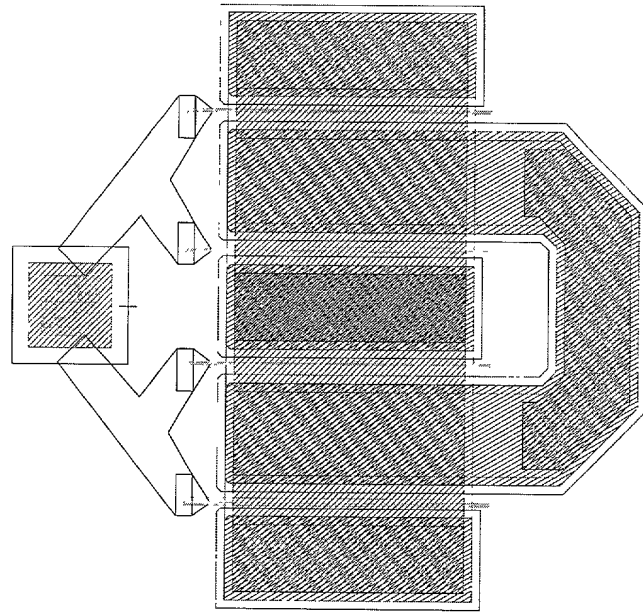


Figure 42A

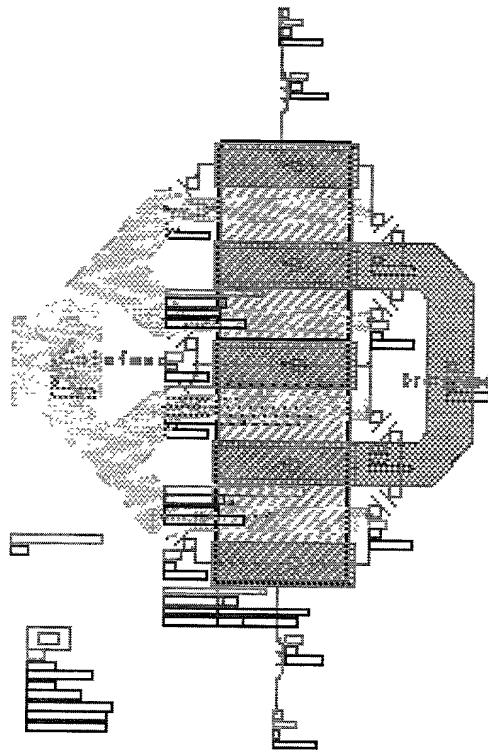


Figure 42B

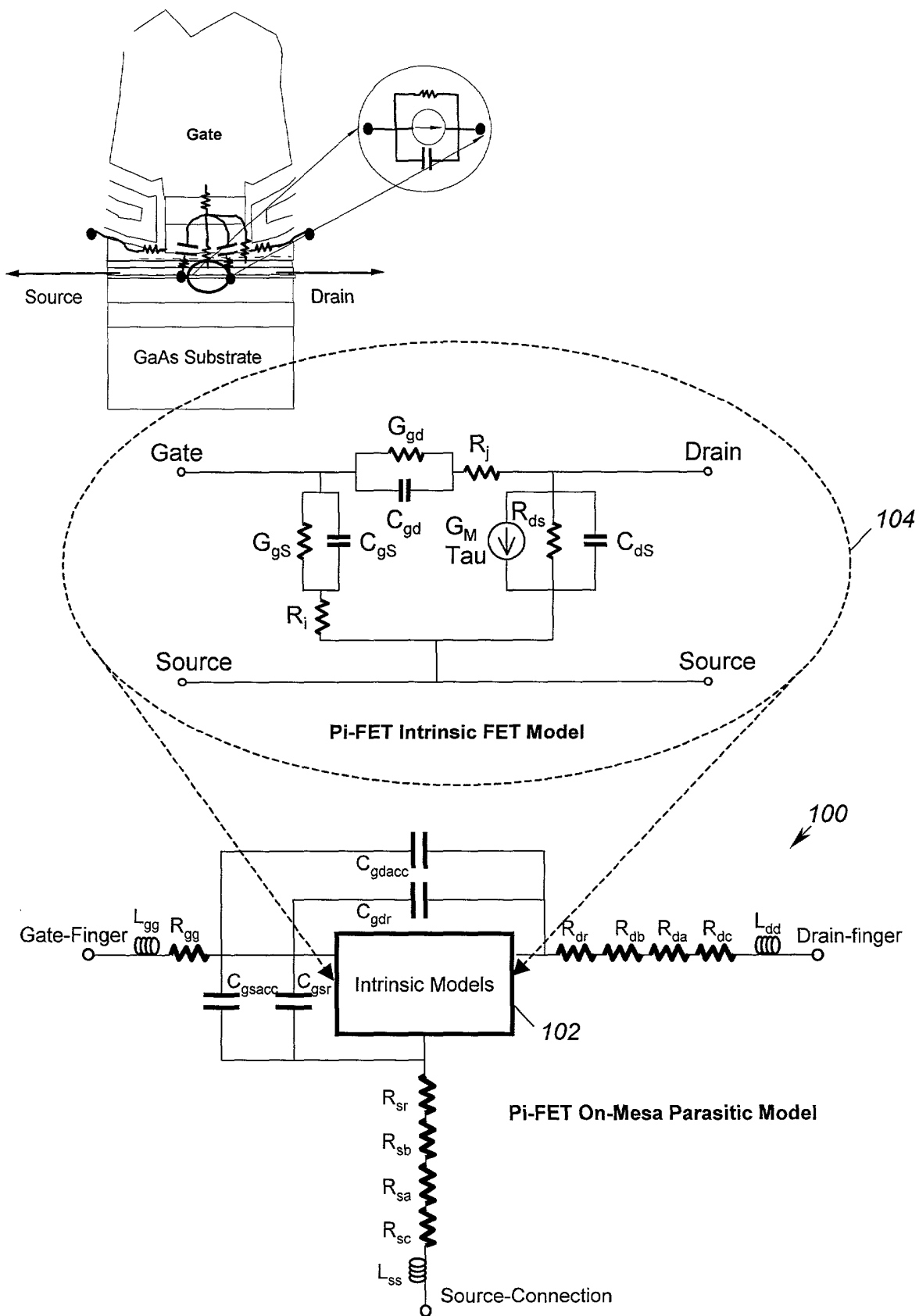


Figure 43

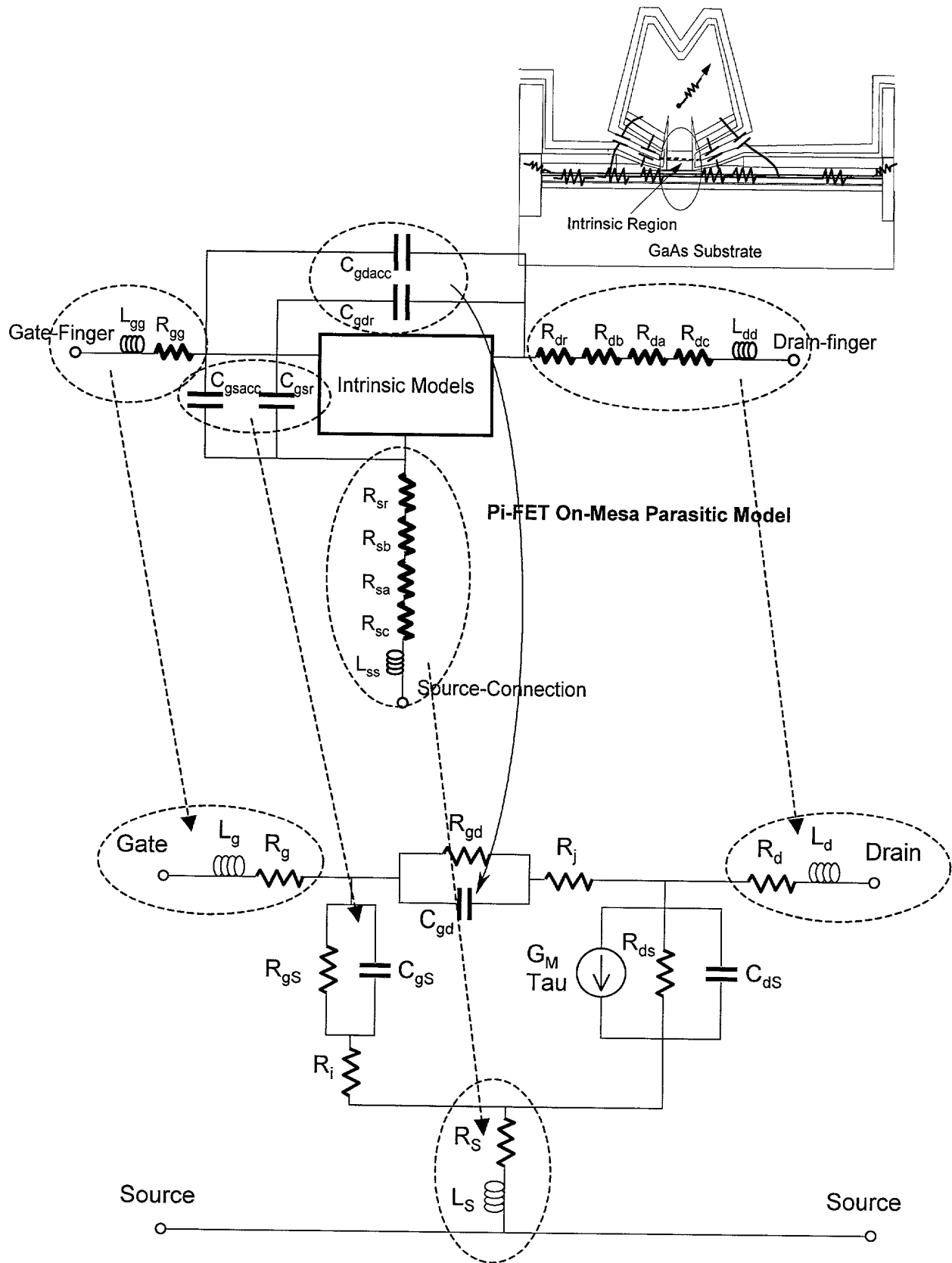


Figure 44

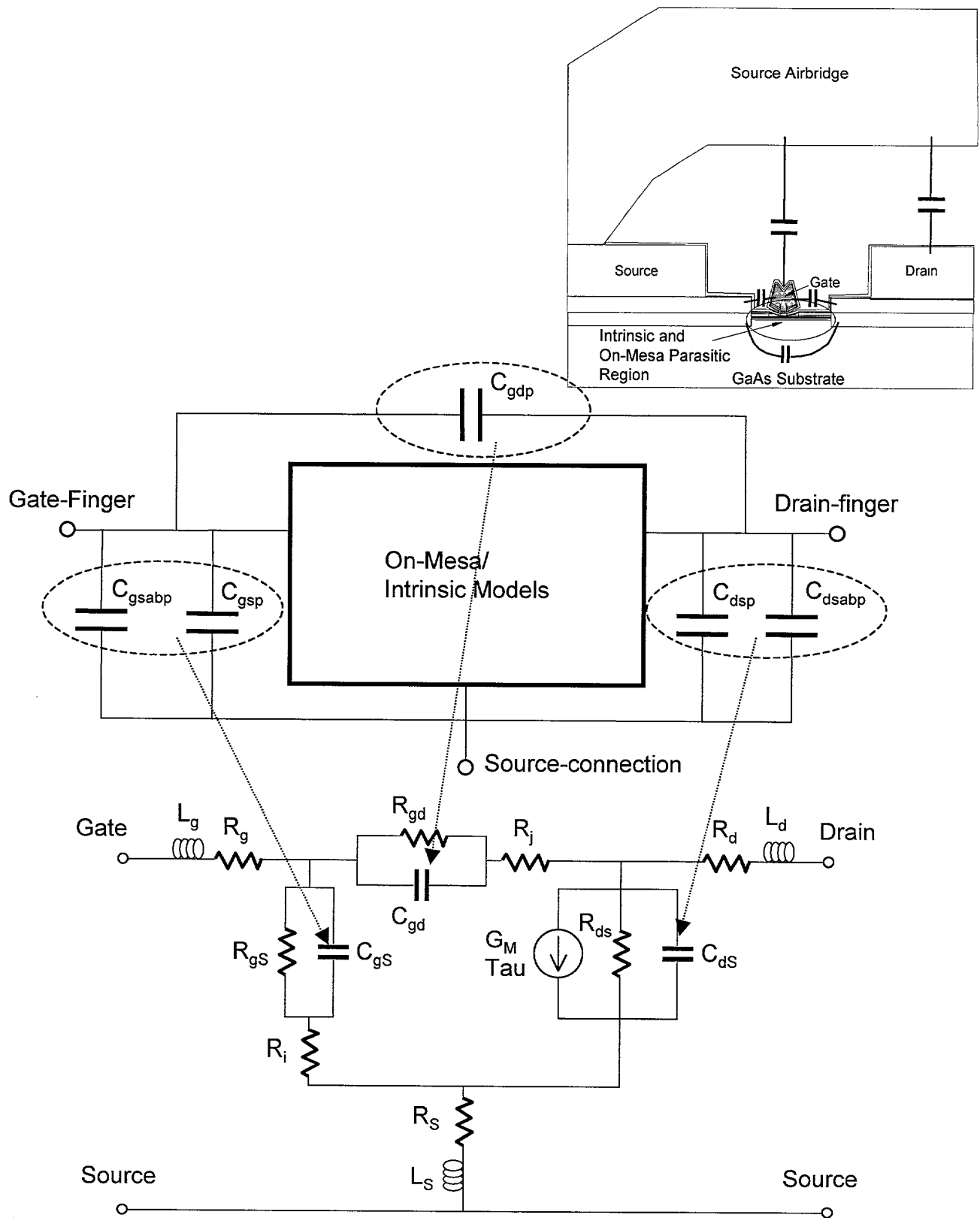


Figure 45

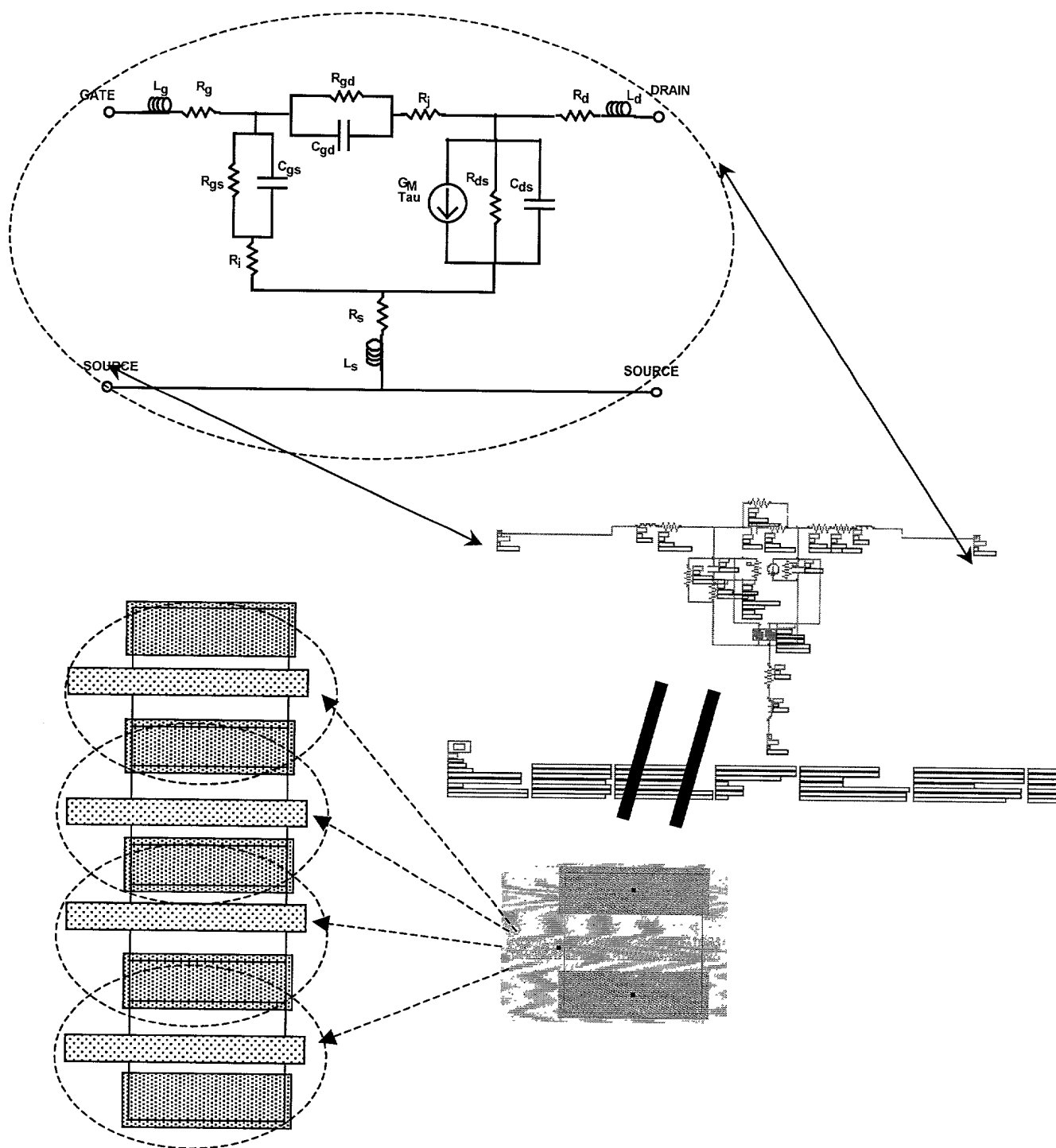


Figure 46

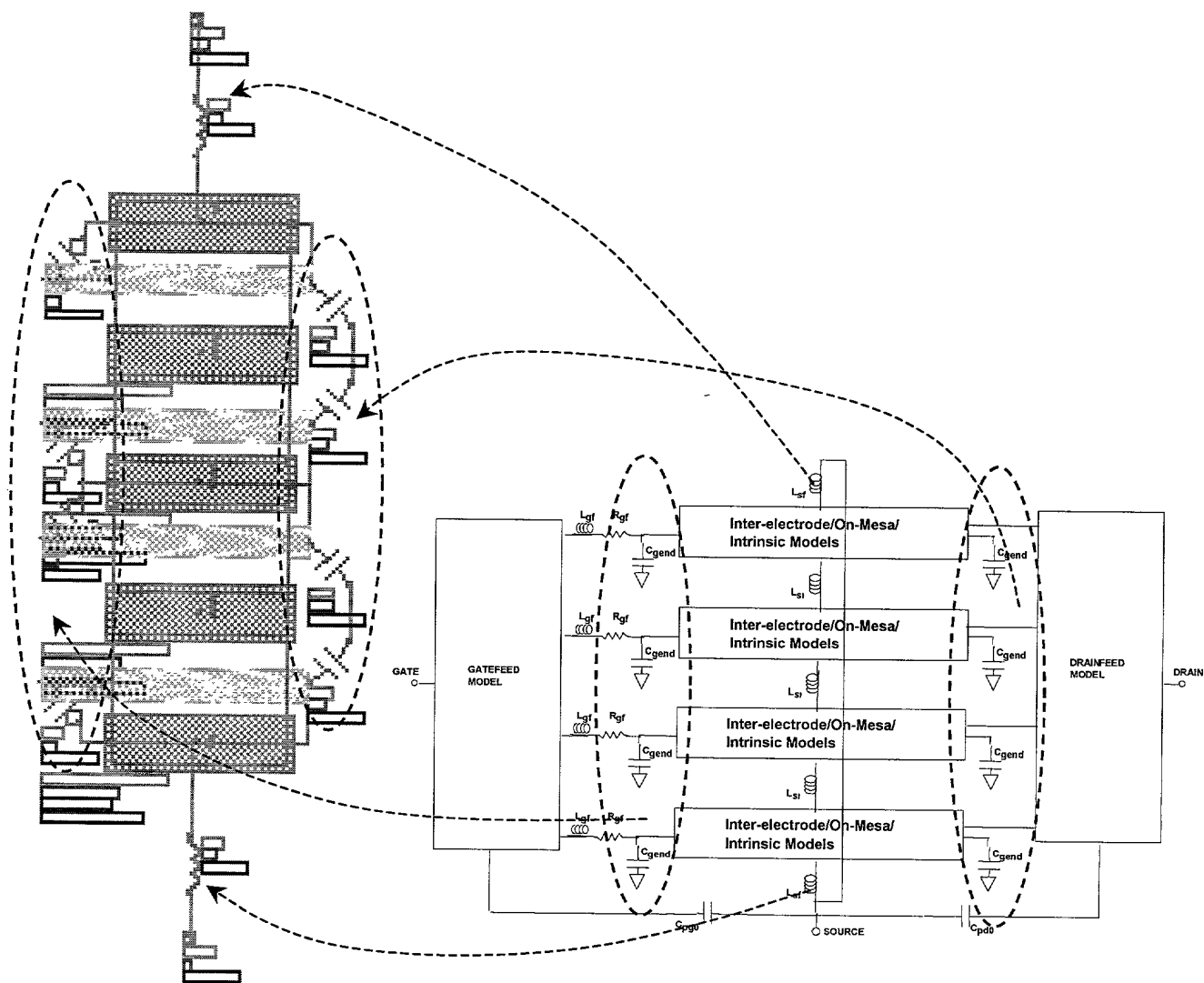


Figure 47

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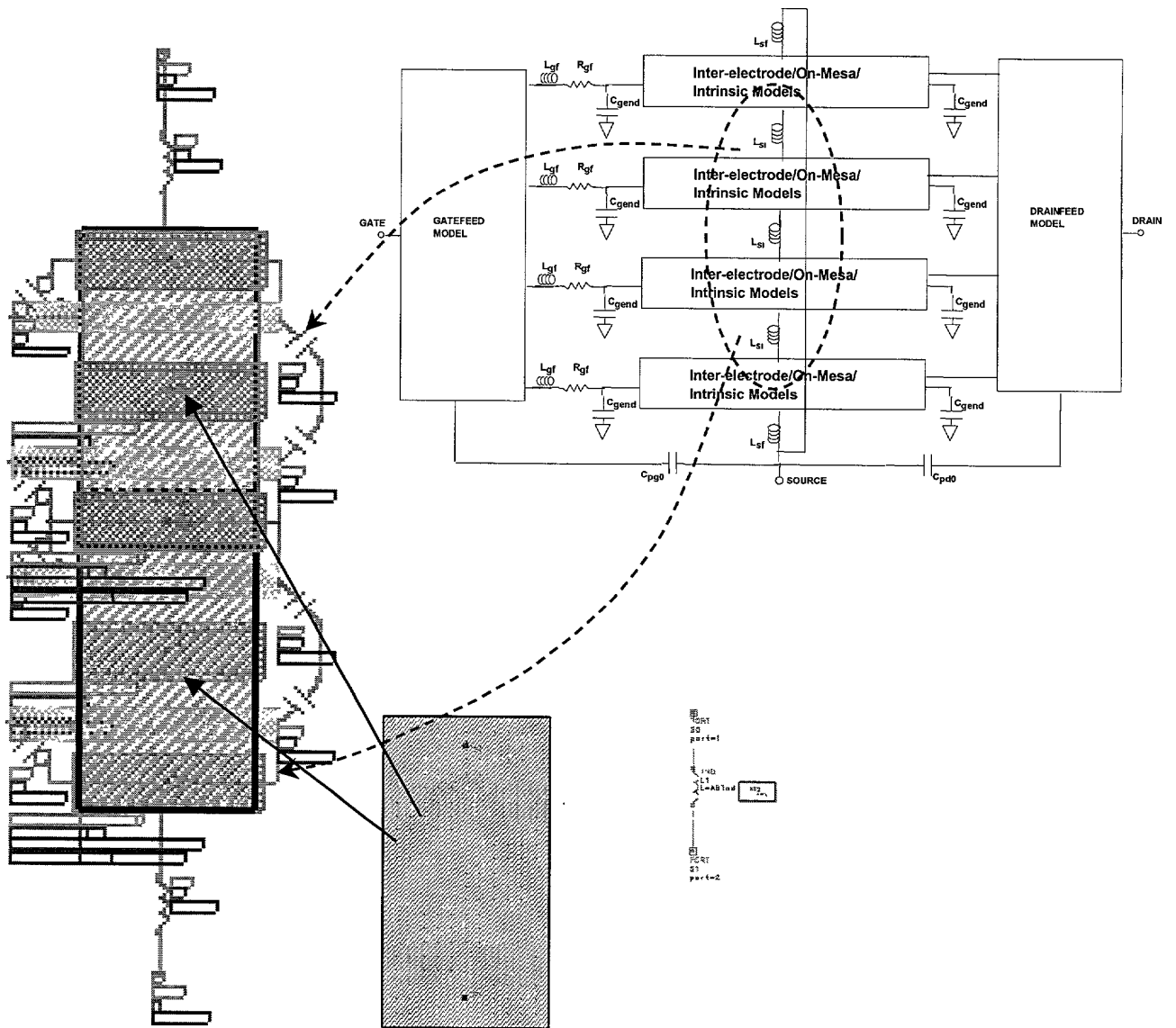
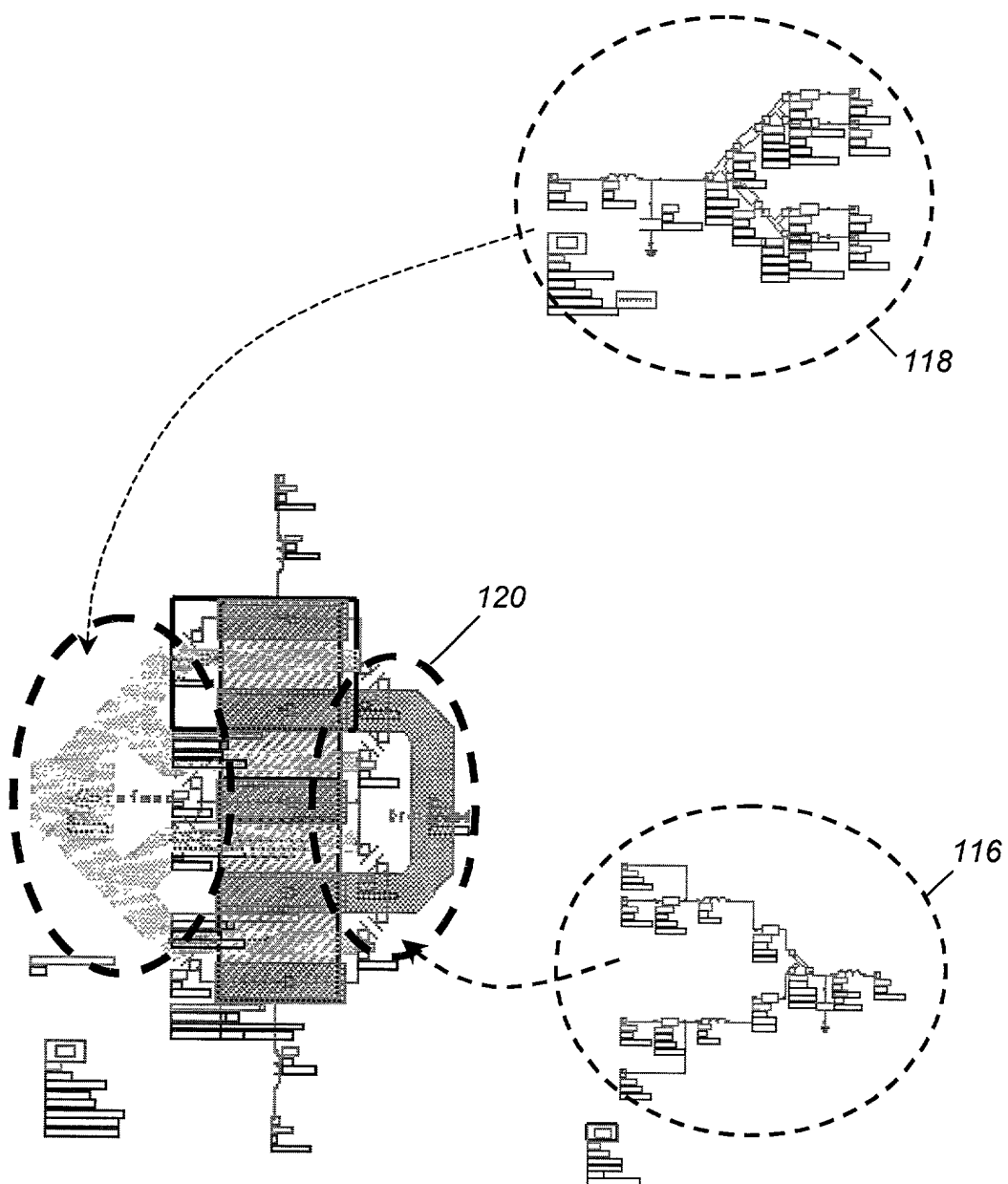


Figure 48



Implementation of the fifth level of embedding

Figure 49

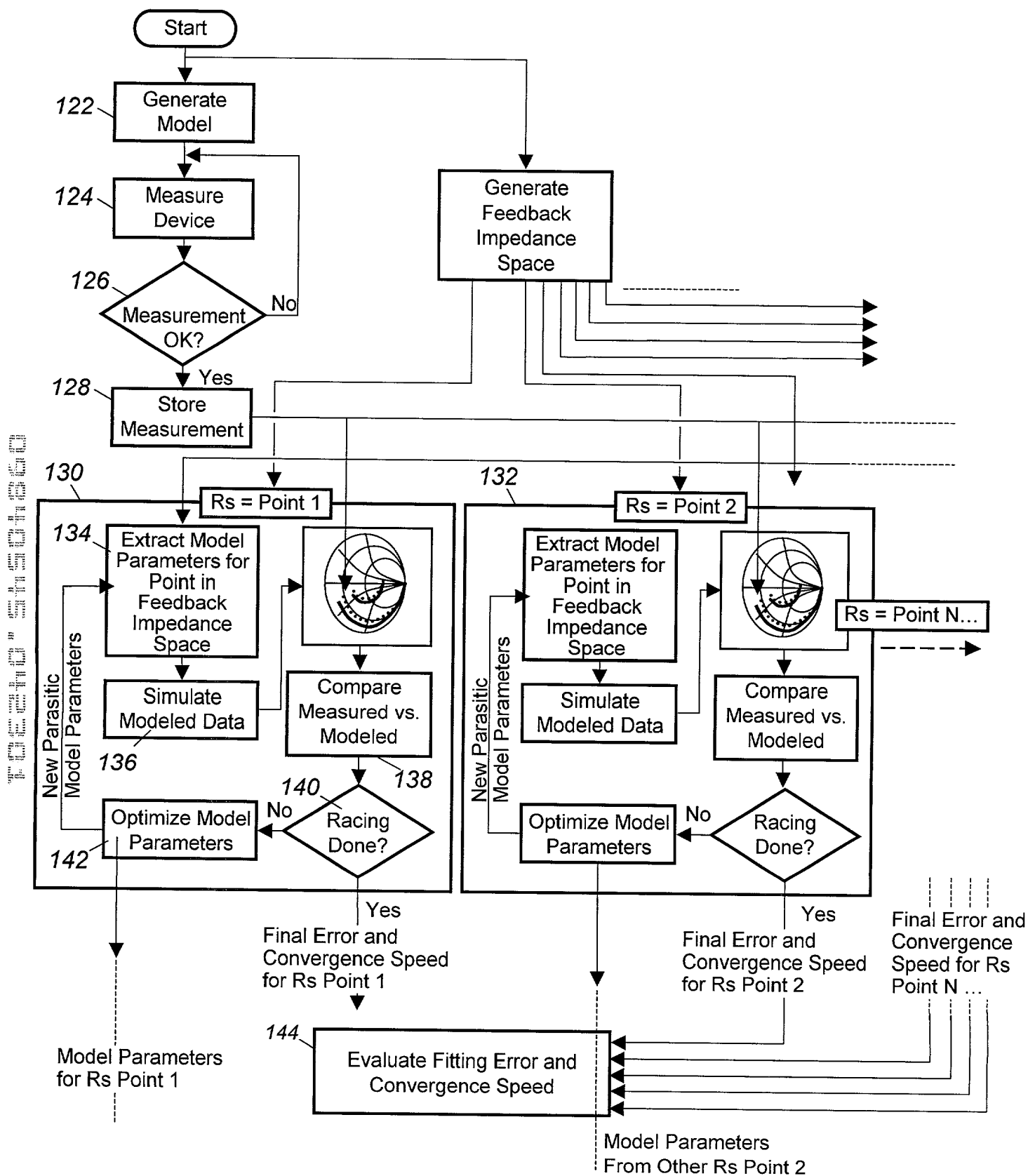


Figure 50A

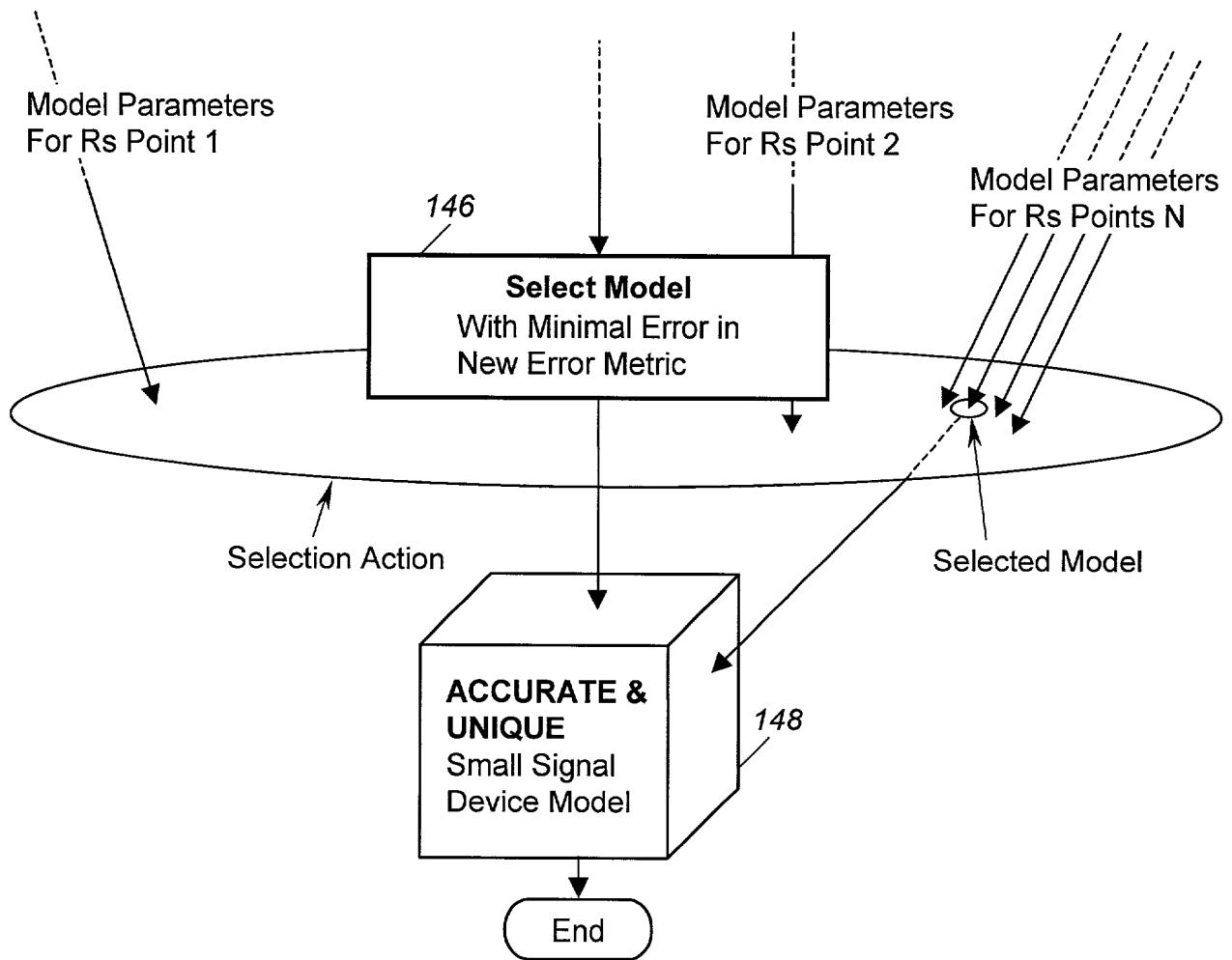
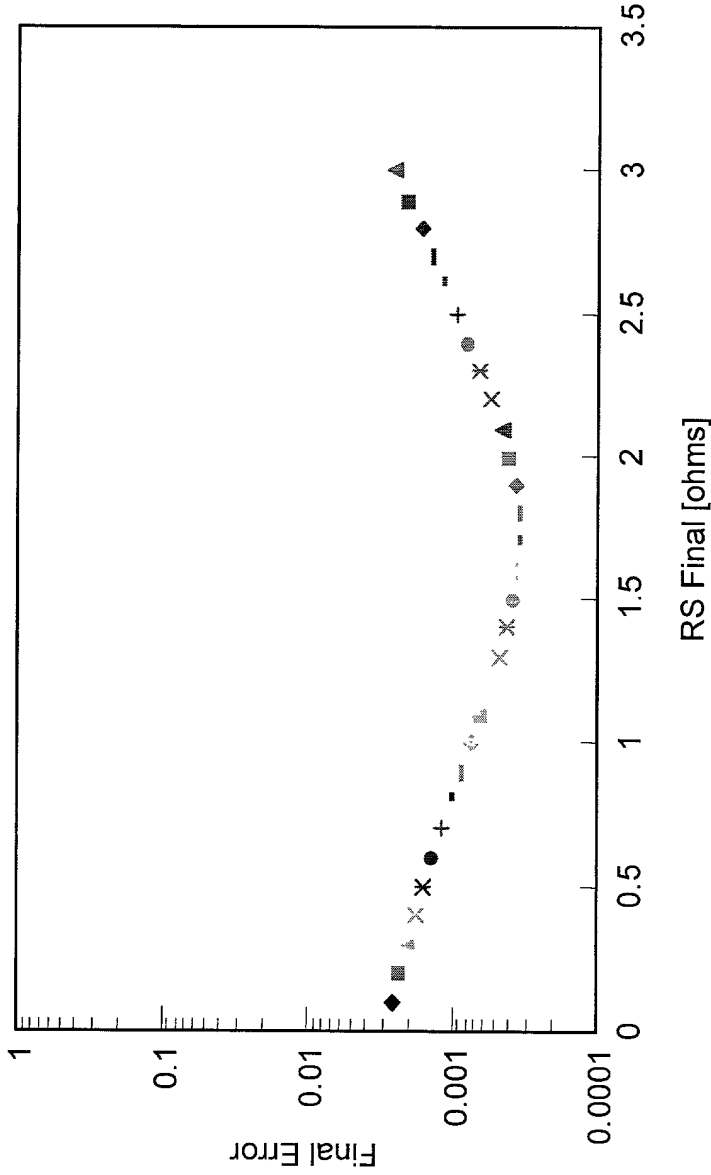


Figure 50B

Final Error vs RS Map for YYY-STATE 1coc__



◆ RS=0.1,RD=0.000004,RG=3.631111
 ■ RS=0.2,RD=0.00006,RG=3.700725
 ✕ RS=0.3,RD=0.00006,RG=3.827767
 ✕ RS=0.4,RD=0.000077,RG=3.917606
 ✕ RS=0.5,RD=0.00002,RG=4.002959
 ● RS=0.6,RD=0.00063,RG=4.121072
 + RS=0.7,RD=0.000672,RG=4.225347
 - RS=0.8,RD=0.00007,RG=4.32573
 - RS=0.9,RD=0.000001,RG=4.427338
 ◆ RS=1.1,RD=0.00042,RG=4.627873
 ✕ RS=1.2,RD=0.380034,RG=4.667158
 ✕ RS=1.3,RD=0.861394,RG=4.69531
 ✕ RS=1.4,RD=1.568092,RG=4.676249
 ● RS=1.5,RD=2.072742,RG=4.704008
 + RS=1.6,RD=2.741666,RG=4.685351
 - RS=1.7,RD=3.309899,RG=4.711895
 - RS=1.8,RD=3.901662,RG=4.722658
 ◆ RS=1.9,RD=4.528121,RG=4.730933
 ■ RS=2.1,RD=5.080991,RG=4.75499
 ▲ RS=2.1,RD=5.649669,RG=4.781182
 ✕ RS=2.2,RD=6.197713,RG=4.81535
 ✕ RS=2.3,RD=6.720198,RG=4.855583
 ● RS=2.4,RD=7.205221,RG=4.909625
 + RS=2.5,RD=7.705211,RG=4.960891
 - RS=2.6,RD=8.202621,RG=5.01476
 - RS=2.7,RD=8.779481,RG=5.030824
 ◆ RS=2.8,RD=9.386087,RG=5.027081
 ■ RS=2.9,RD=9.911043,RG=5.074825
 ▲ RS=3.1,RD=10.48296,RG=5.083981
 ✕ RS=0.911268,RD=3.009443,RG=4.152256
 ✕ RS=1.439659,RD=3.33544,RG=3.769519
 ✕ RS=1.606168,RD=3.520349,RG=3.502953

Figure 51

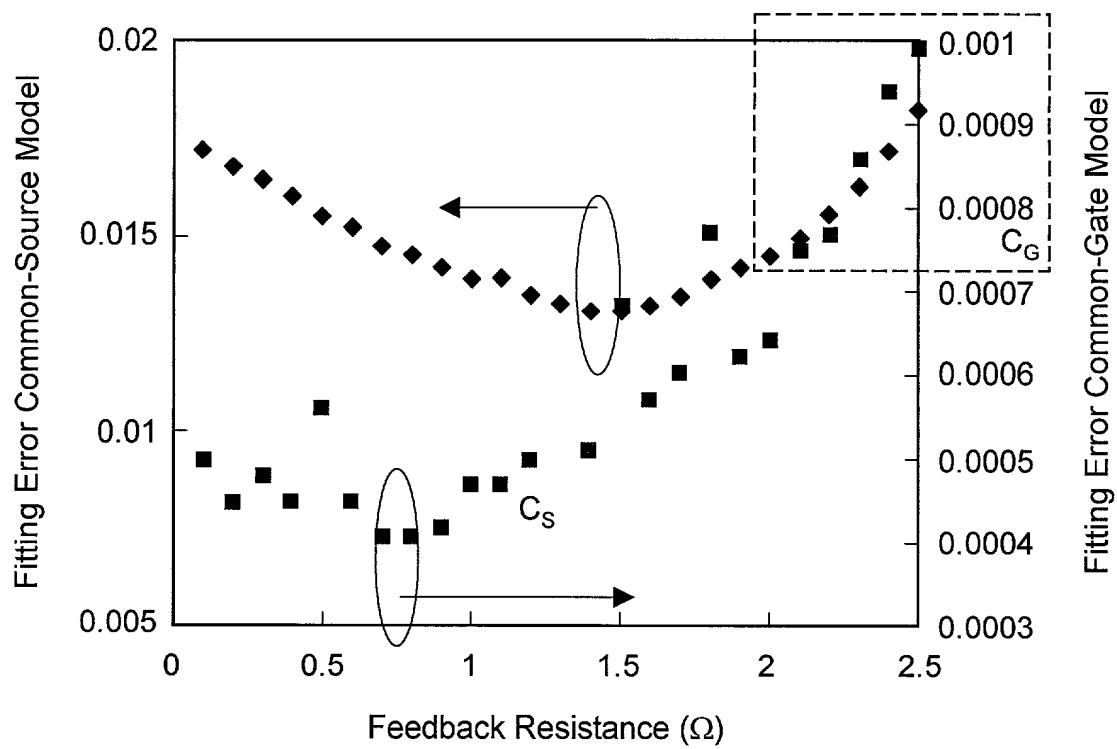
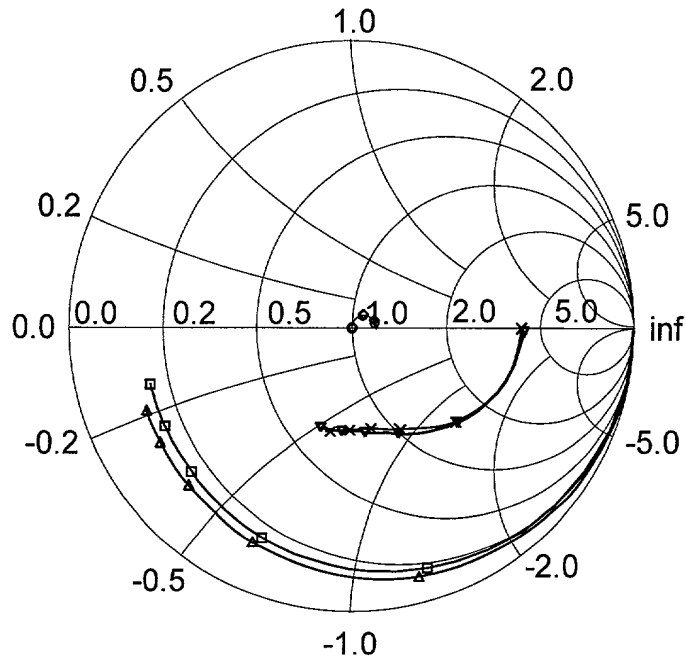


Figure 52

□ measure	○ measure	▽ measure	△ Simulated	◇ Simulated	× Simulated
SMAT1	SMAT1	SMAT1	SMAT1	SMAT1	SMAT1
S[1,1]	S[1,2]	S[2,2]	S[1,1]	S[1,2]	S[2,2]



Frequency 0.05 to 40.05 GHz

Figure 53A

□ measure	○ Simulated	▽ measure	△ Simulated
SMAT1	SMAT1	SMAT1	SMAT1
S[2,1]	S[2,1]	S[2,1]	S[2,1]
dB	db	Ang	Ang
		deg	deg

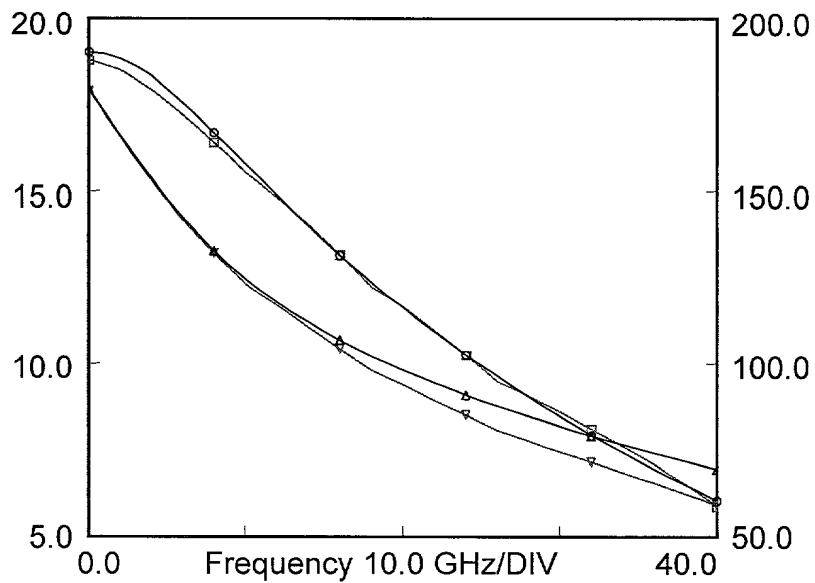
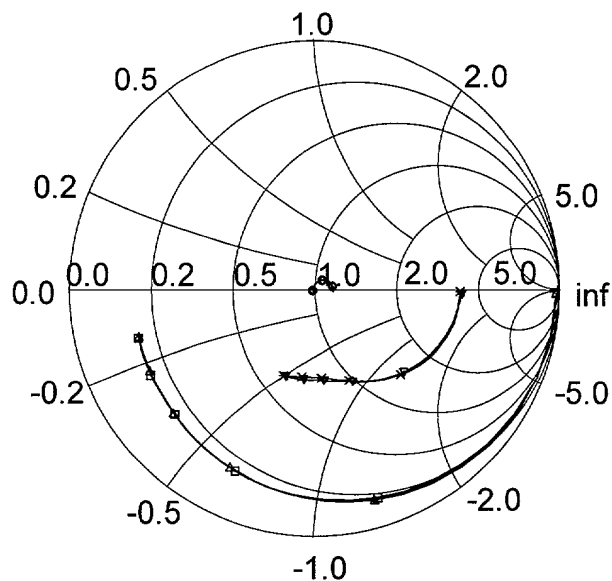


Figure 53B

□ measure SMAT1 S[1,1] ○ measure SMAT1 S[1,2] ▽ measure SMAT1 S[2,2] △ Simulated SMAT1 S[1,1] ◇ Simulated SMAT1 S[1,2] × Simulated SMAT1 S[2,2]



Frequency 0.05 to 40.05 GHz

Figure 54A

□ measure SMAT1 S[2,1] dB ○ Simulated SMAT1 S[2,1] db ▽ measure SMAT1 S[2,1] Ang deg △ Simulated SMAT1 S[2,1] Ang deg

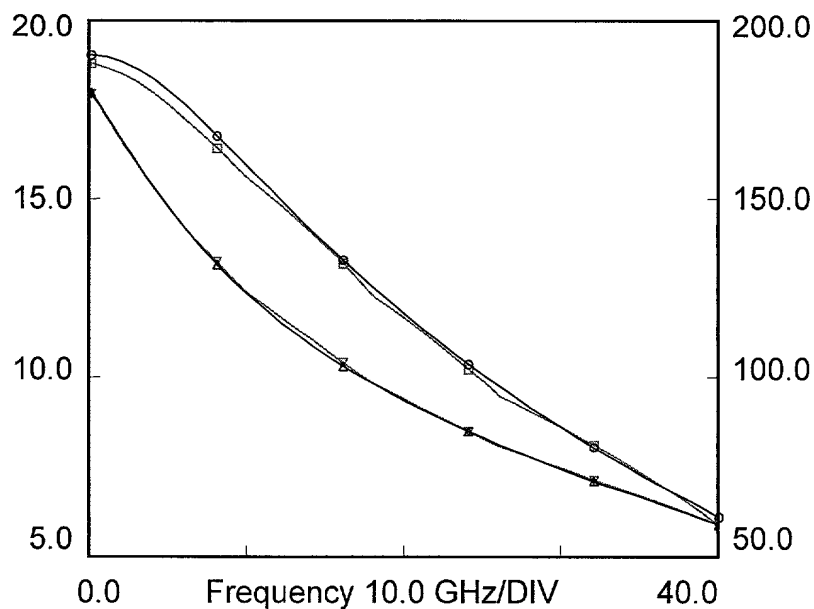
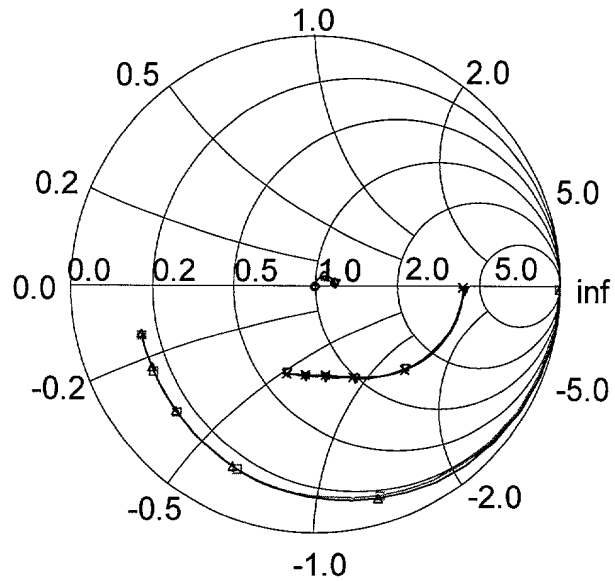


Figure 54B

□ measure SMAT1 S[1,1]	○ measure SMAT1 S[1,2]	▽ measure SMAT1 S[2,2]	△ Simulated SMAT1 S[1,1]	◇ Simulated SMAT1 S[1,2]	× Simulated SMAT1 S[2,2]
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Frequency 0.05 to 40.05 GHz

Figure 55A

□ measure SMAT1 S[2,1] dB	○ Simulated SMAT1 S[2,1] db	▽ measure SMAT1 S[2,1] Ang deg	△ Simulated SMAT1 S[2,1] Ang deg
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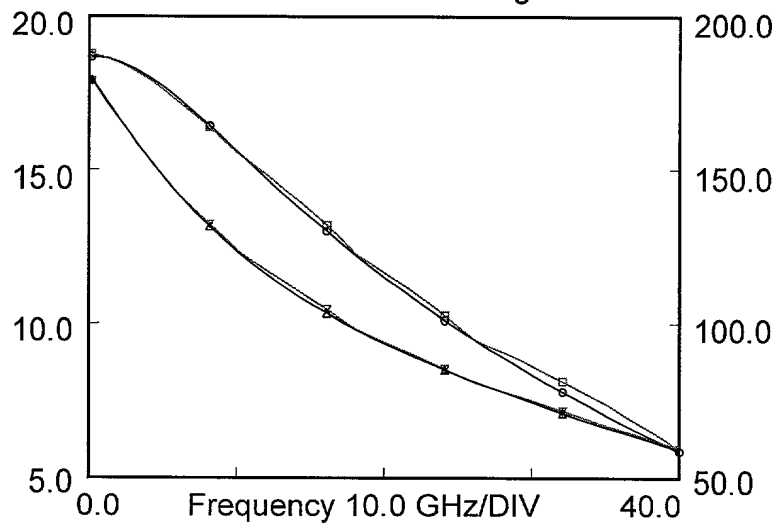


Figure 55B

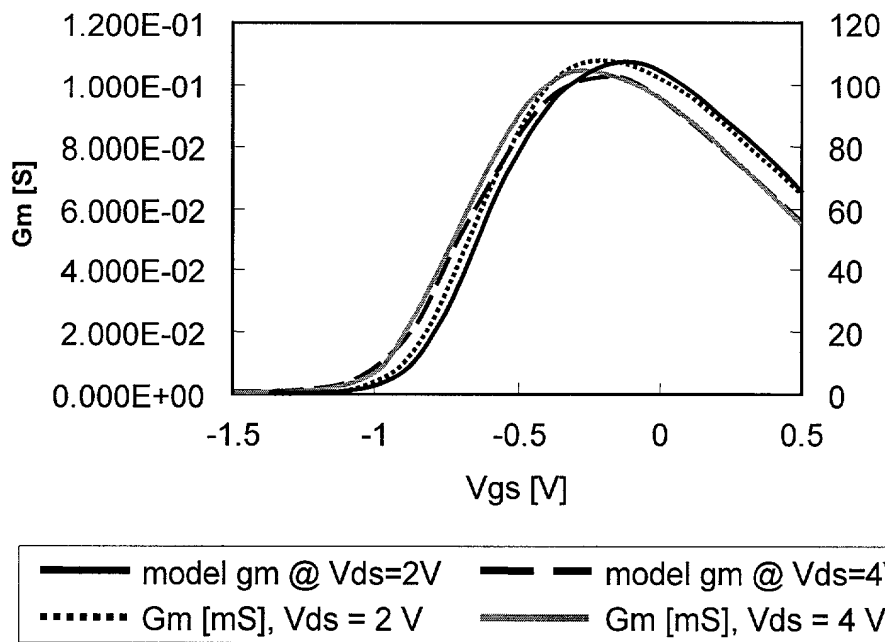


Figure 56

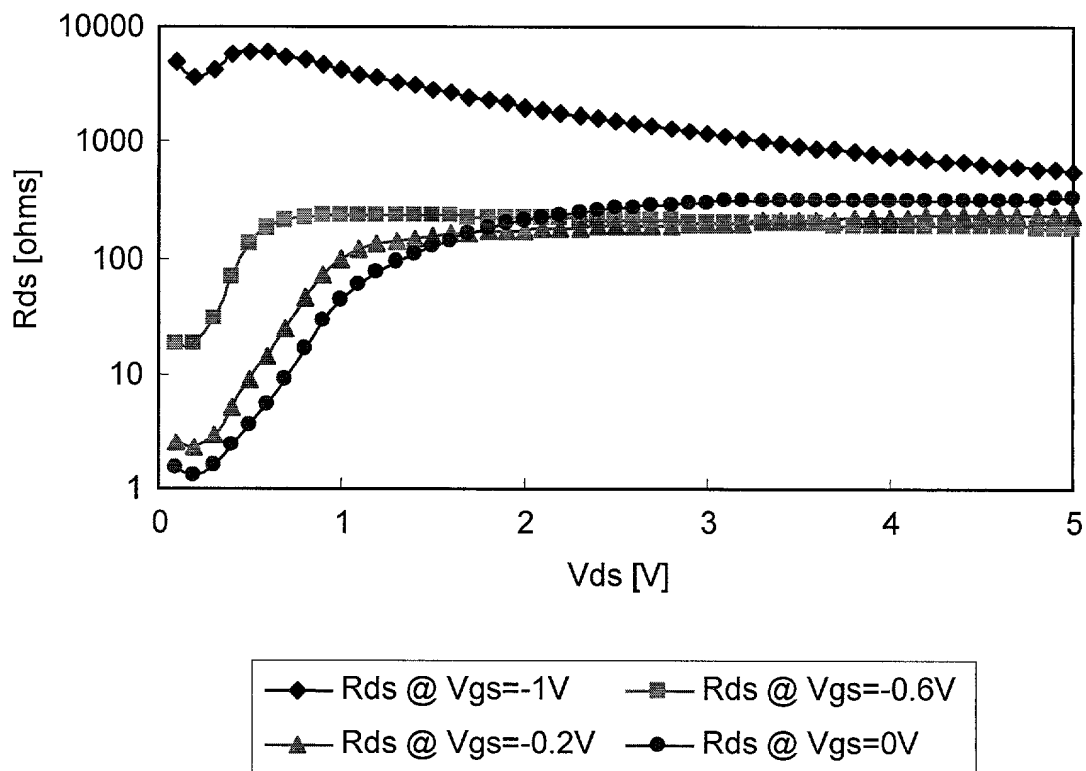


Figure 57

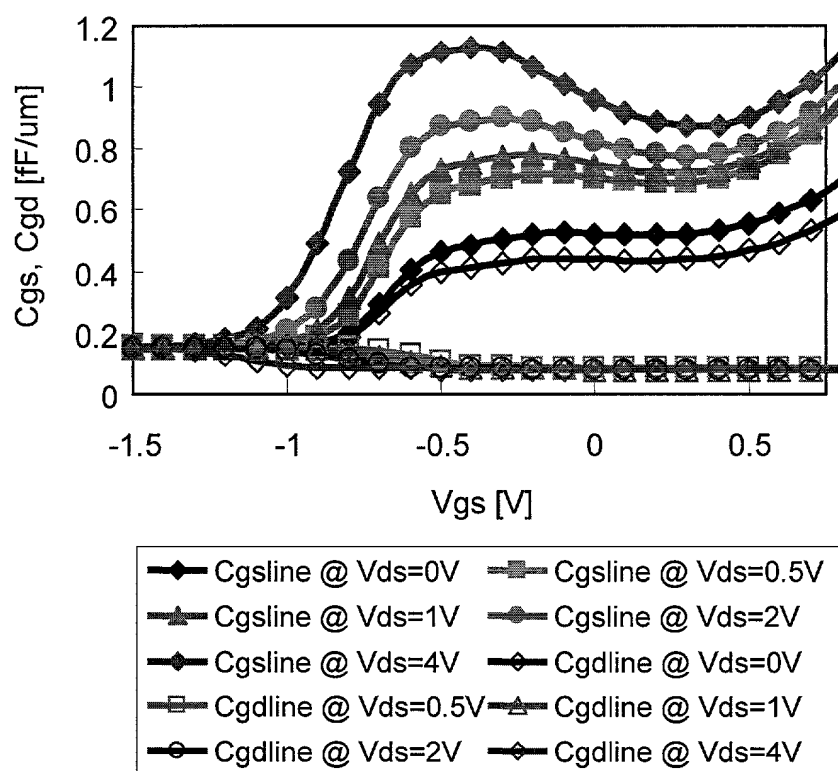


Figure 58

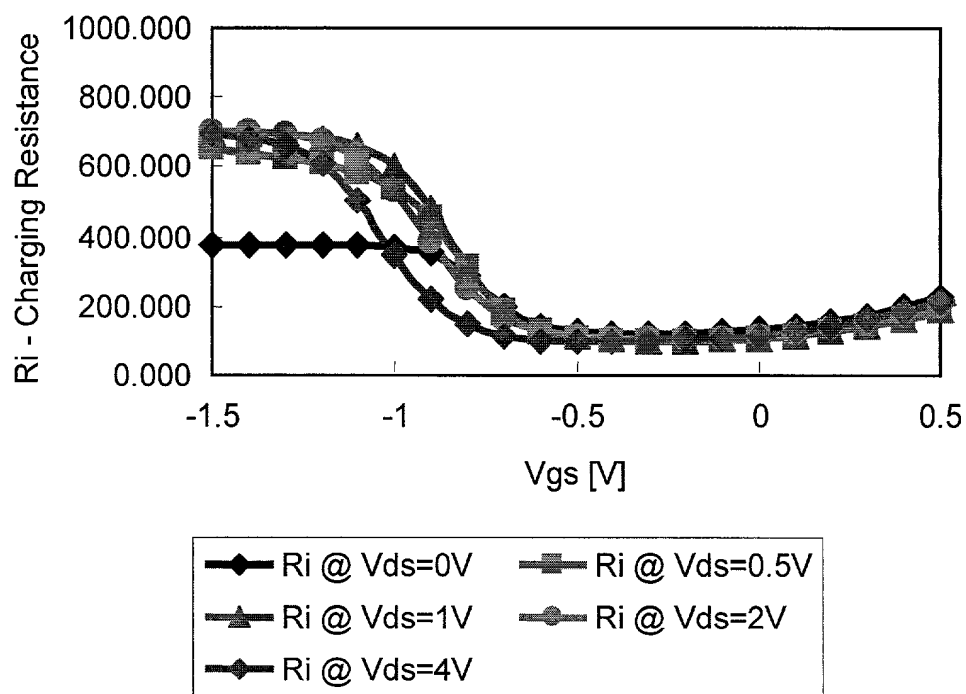


Figure 59

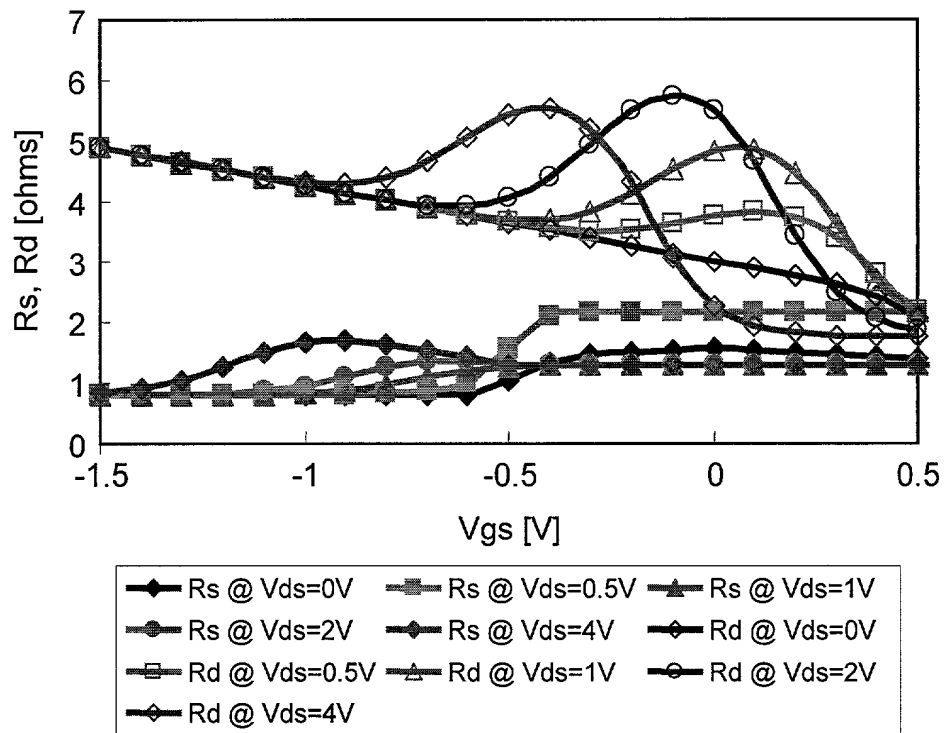


Figure 60

Measured vs Simulated Bias- Dependent Gain @ 23.5 GHz

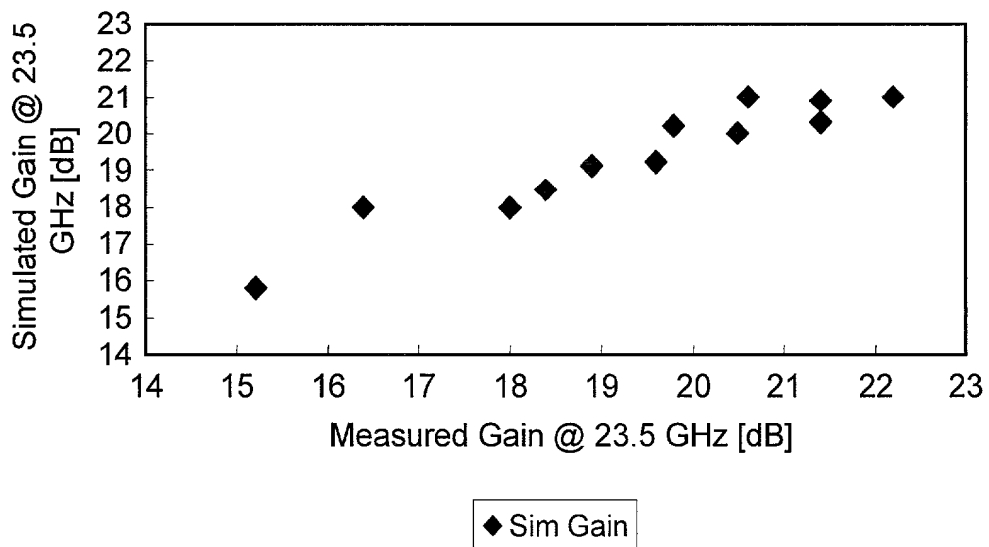


Figure 61

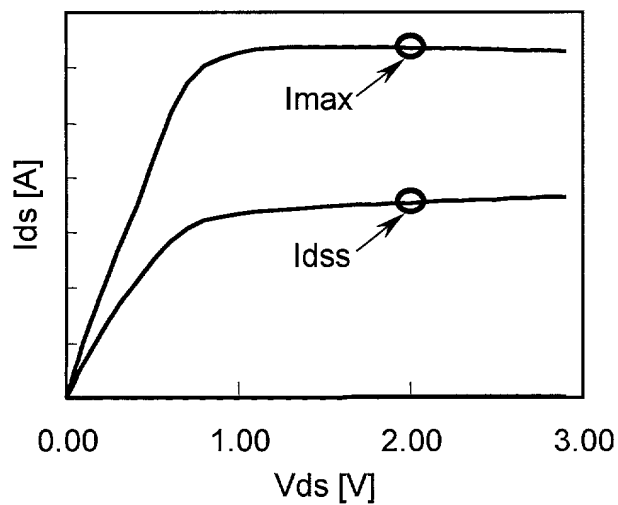


Figure 62A

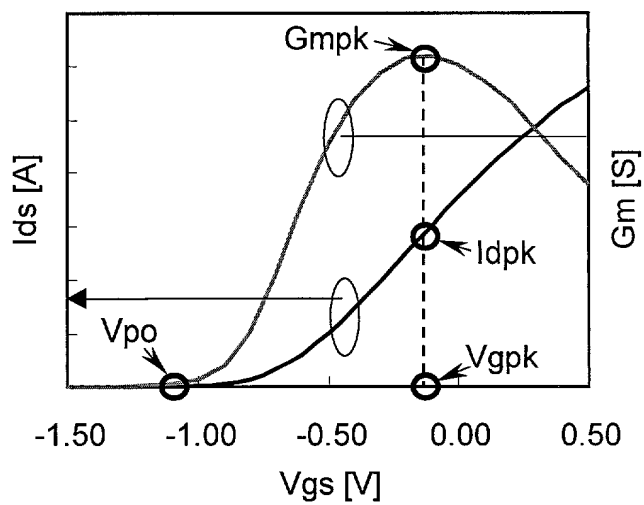


Figure 62B

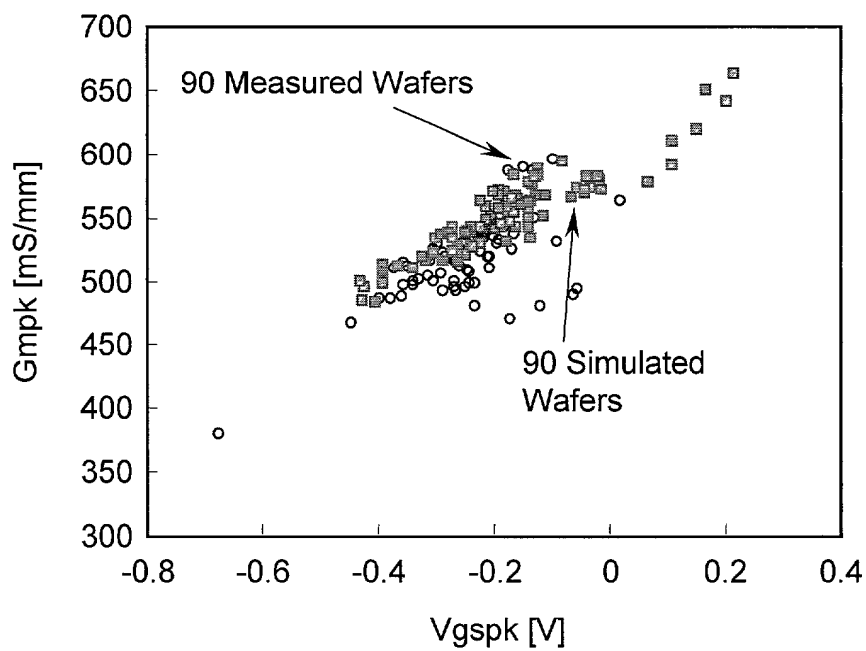


Figure 63

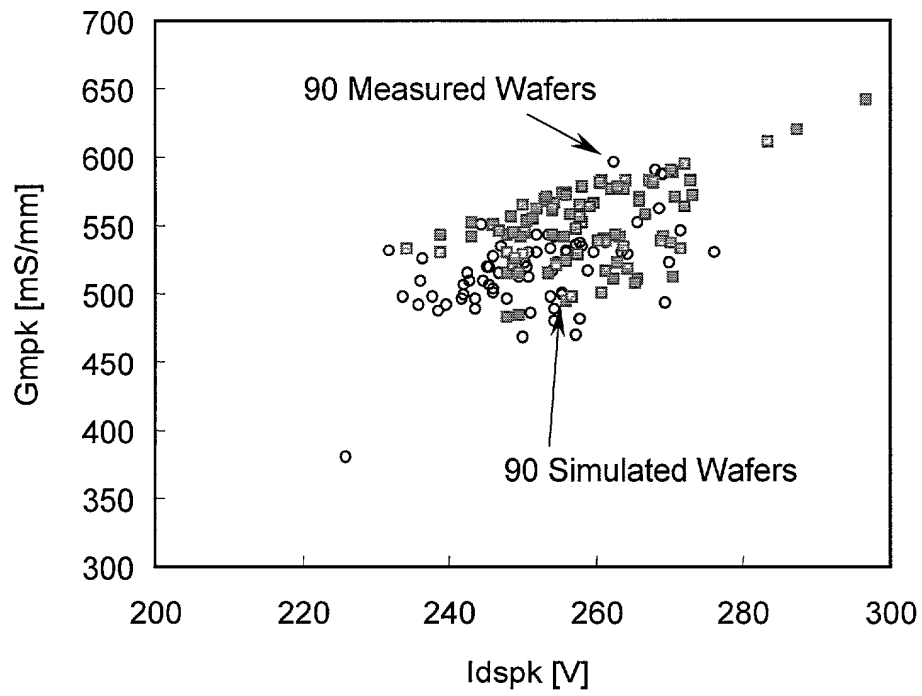


Figure 64

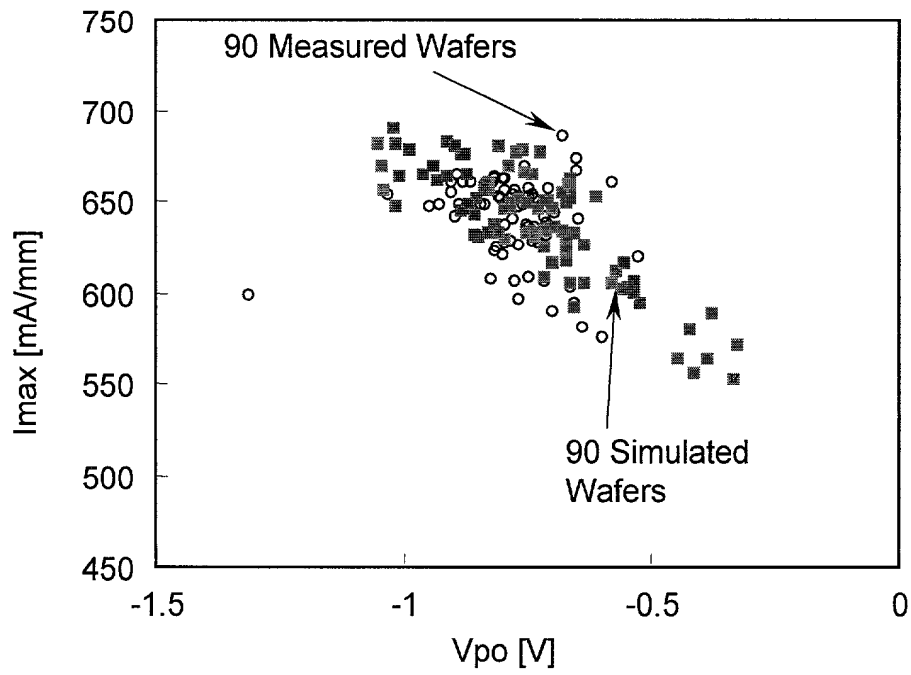


Figure 65

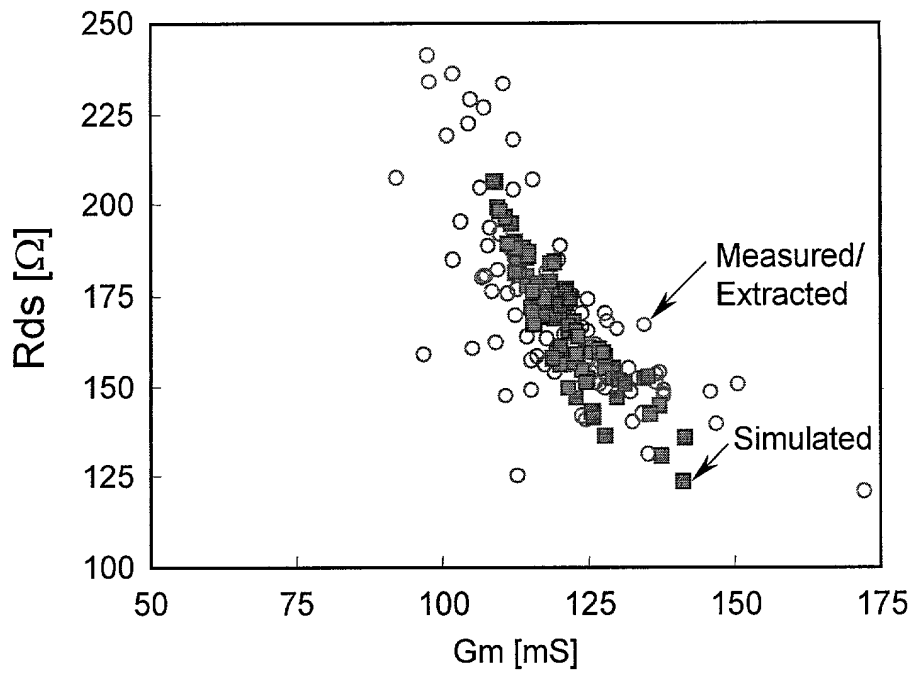


Figure 66

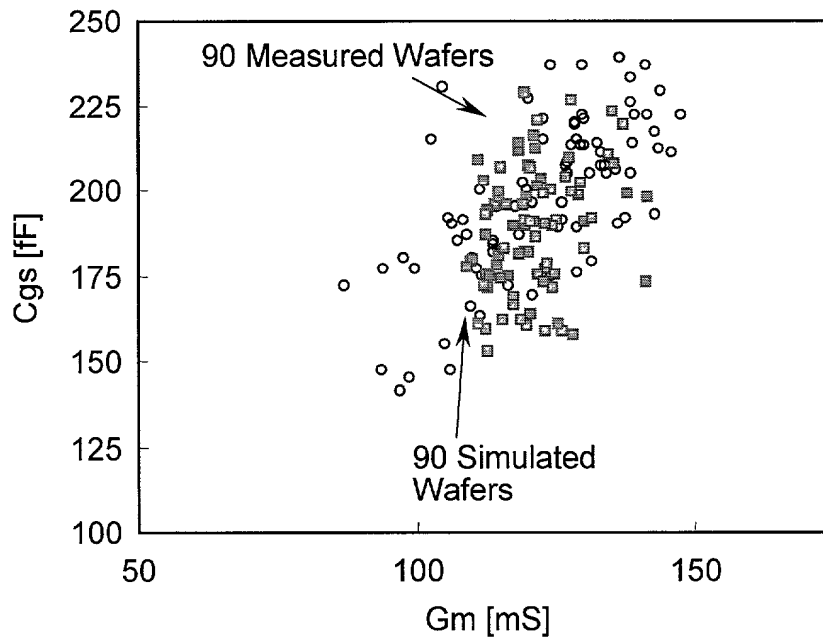


Figure 67

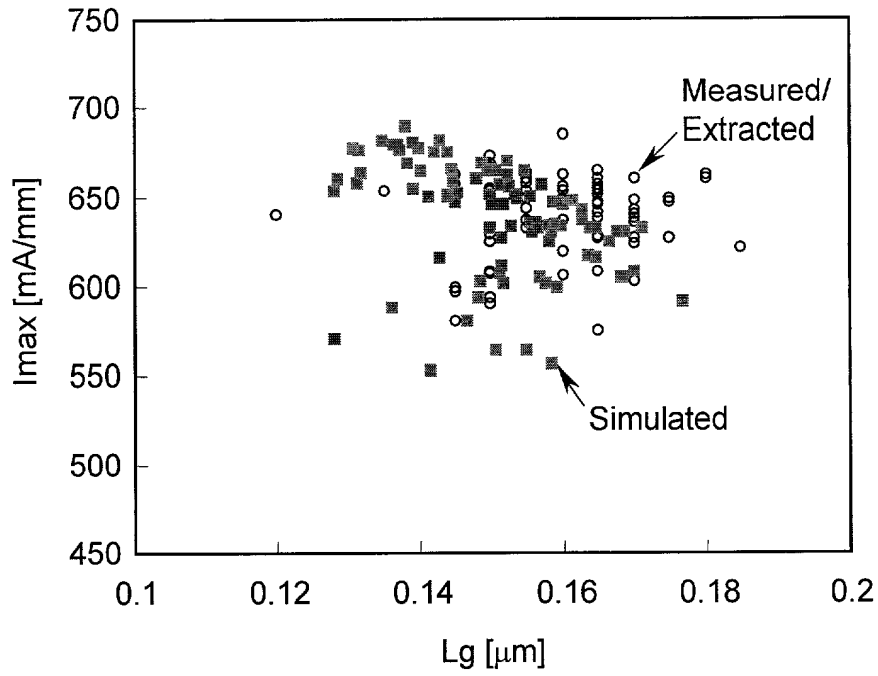


Figure 68

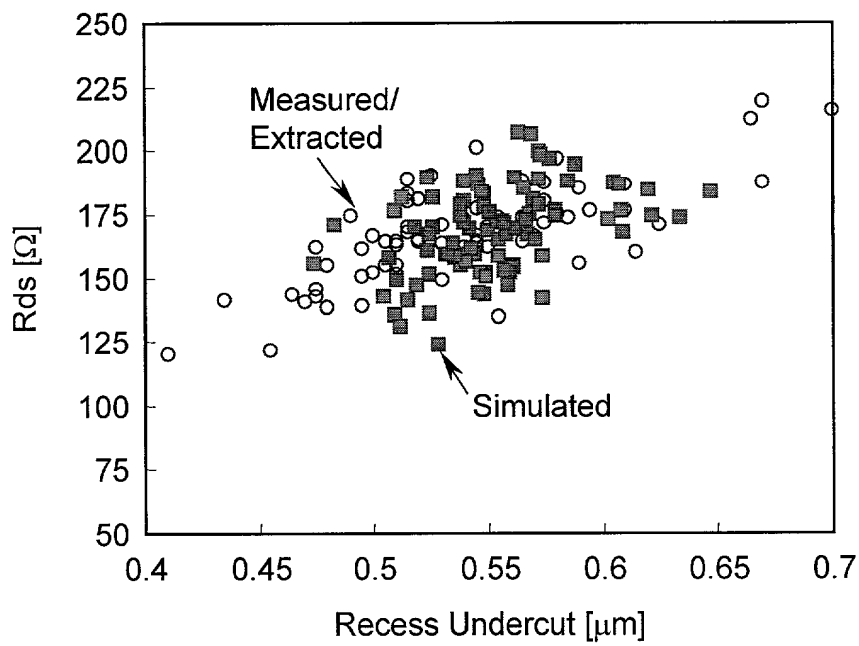


Figure 69